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FIG. 1

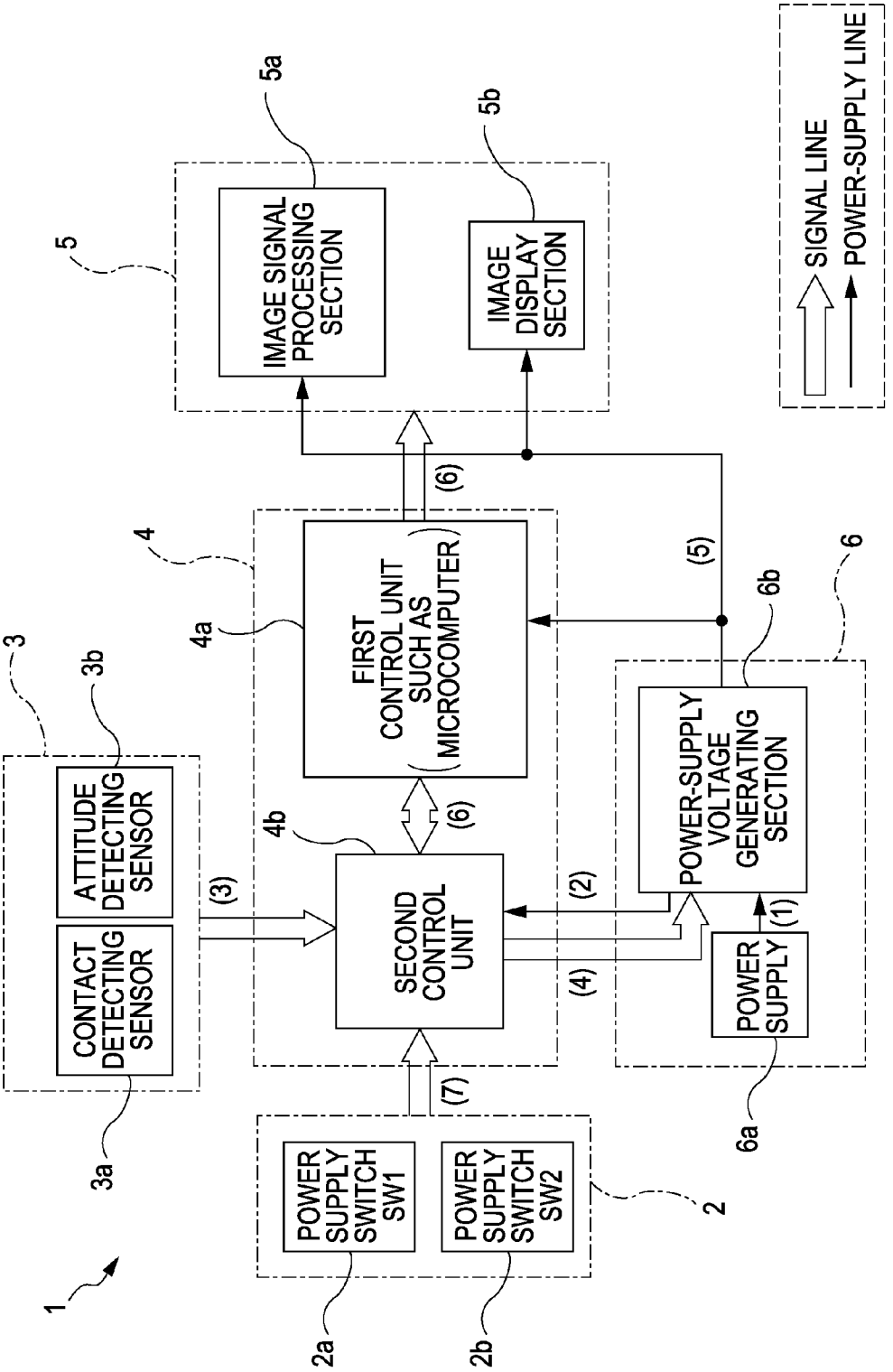

SIGNAL LINE
POWER-SUPPLY LINE
IMAGE SIGNAL PROCESSING SECTION
IMAGE DISPLAY SECTION
FIRST CONTROL UNIT SUCH AS MICROCOMPUTER
SECOND CONTROL UNIT
POWER-SUPPLY VOLTAGE GENERATING SECTION
POWER SUPPLY
ATTITUDE DETECTING SENSOR
CONTACT DETECTING SENSOR
POWER SUPPLY SWITCH SW1
POWER SUPPLY SWITCH SW2
1
2
2a
2b
3
3a
3b
4
4a
4b
5
5a
5b
6
6a
6b
(1)
(2)
(3)
(4)
(5)
(6)
(7)

FIG. 2A

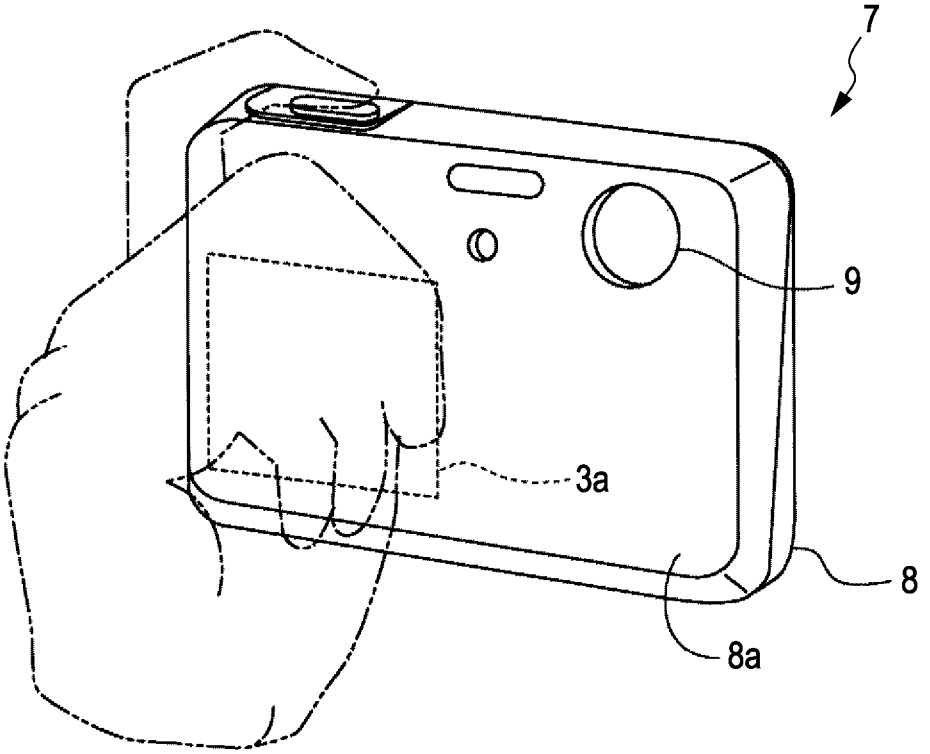


FIG. 2B

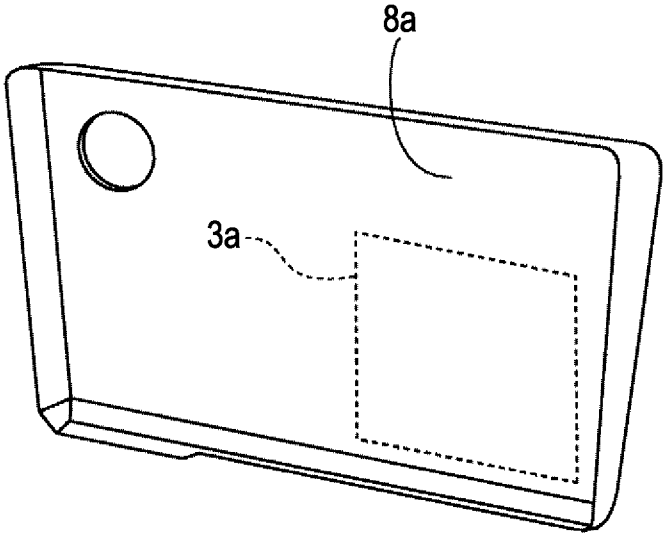


FIG. 3A

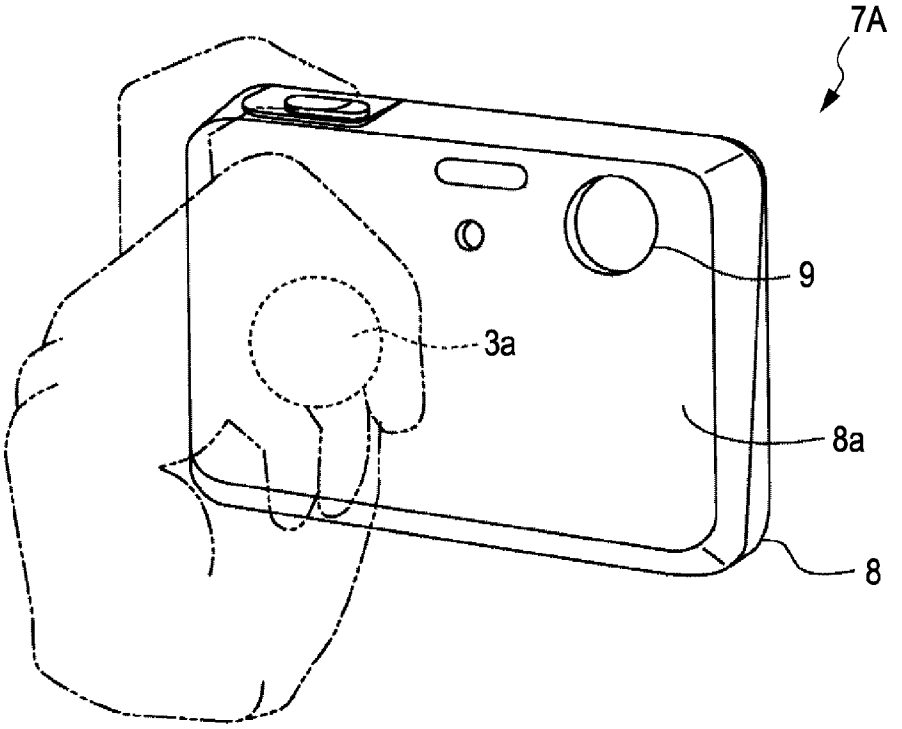


FIG. 3B

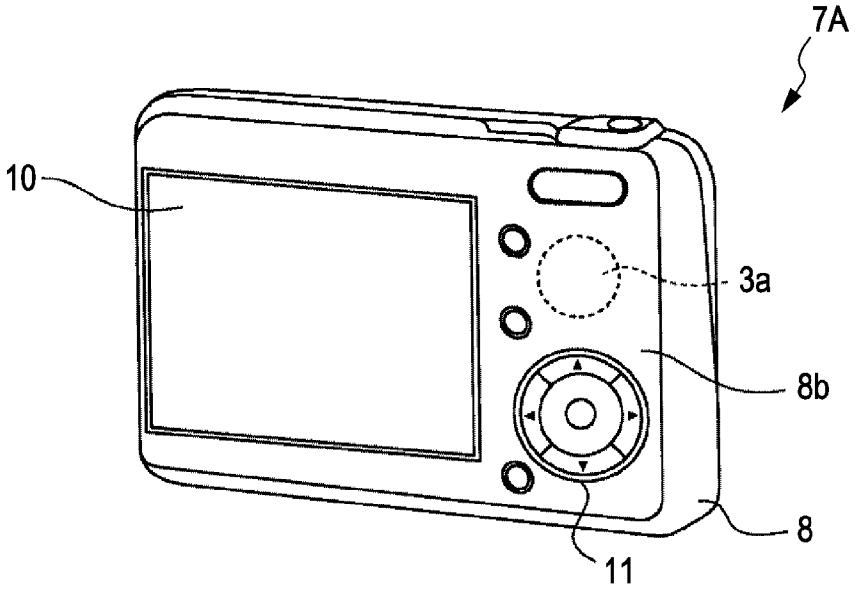
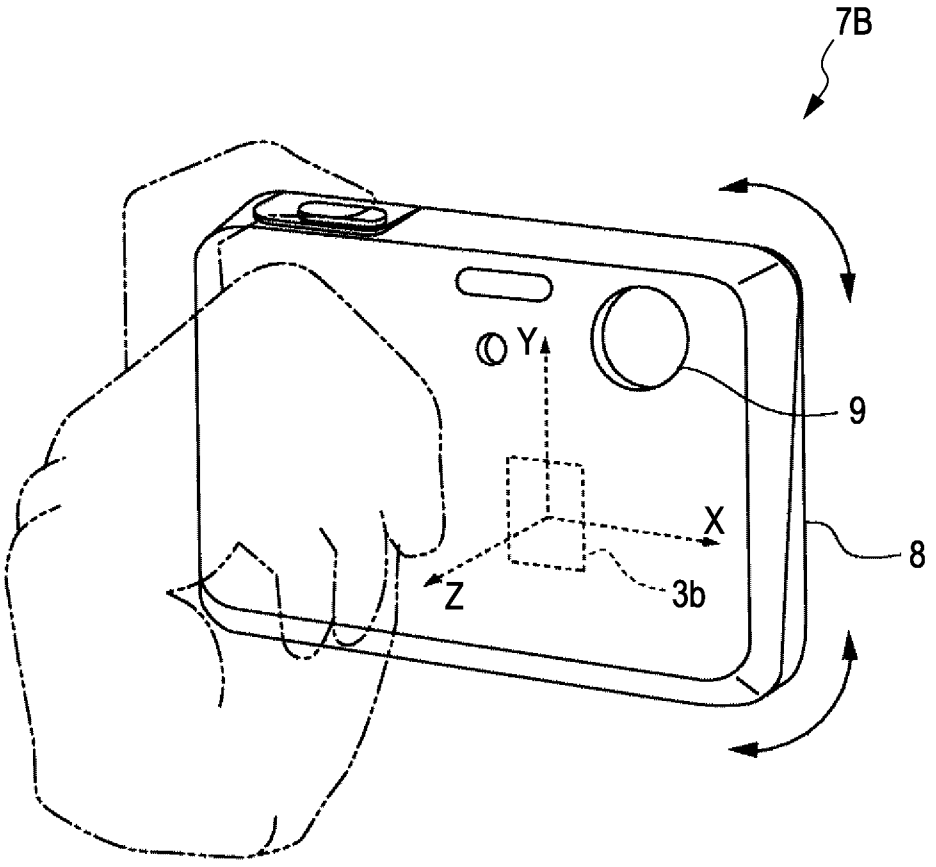


FIG. 4



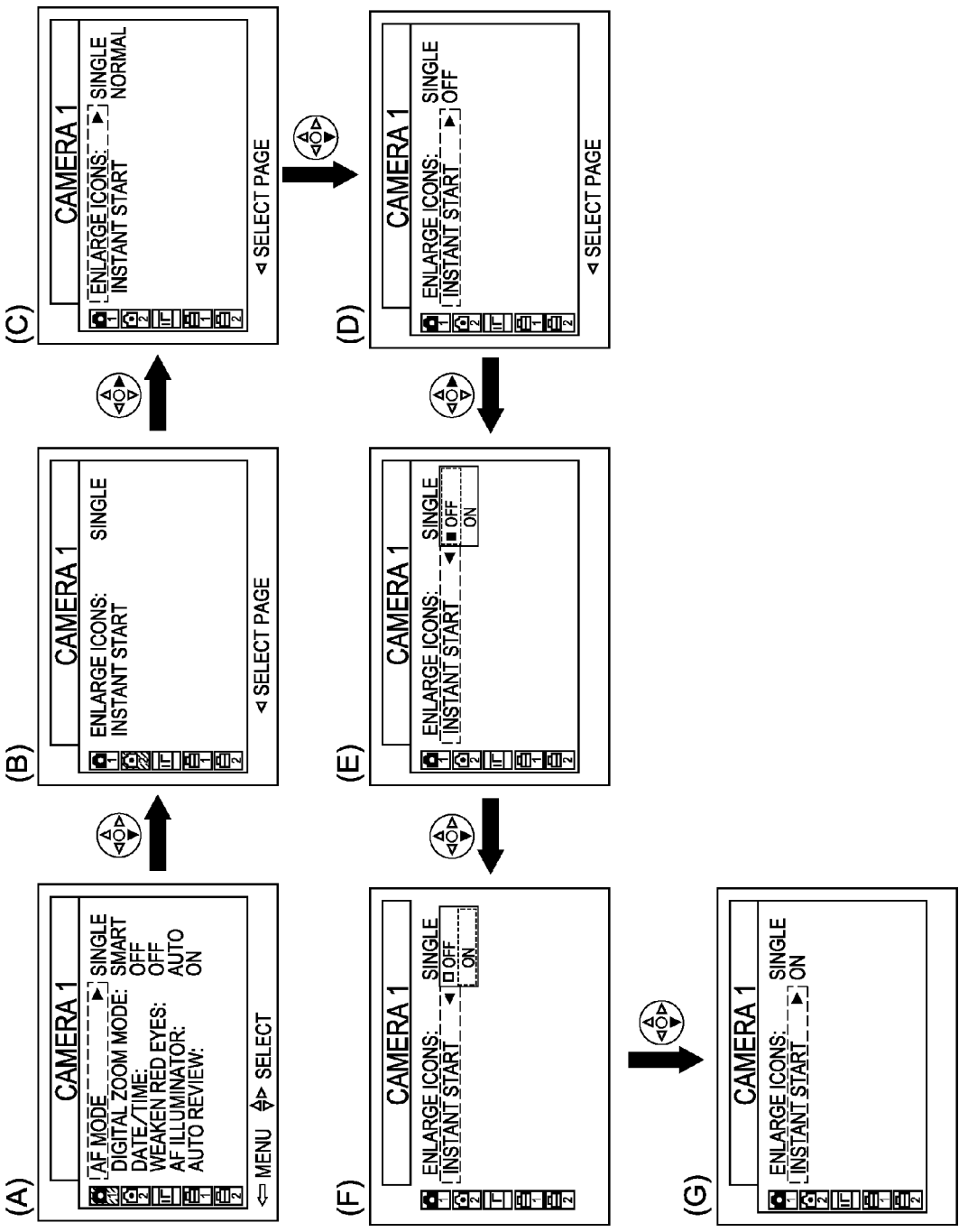

(A)
CAMERA 1
AF MODE SINGLE
DIGITAL ZOOM MODE: SMART
DATE/TIME: OFF
WEAKEN RED EYES: OFF
AF ILLUMINATOR: AUTO
AUTO REVIEW: ON
MENU SELECT
(B)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START
SELECT PAGE
(C)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START NORMAL
SELECT PAGE
(D)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START OFF
SELECT PAGE
(E)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START OFF ON
(F)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START OFF ON
(G)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START ON

FIG. 5

FIG. 6

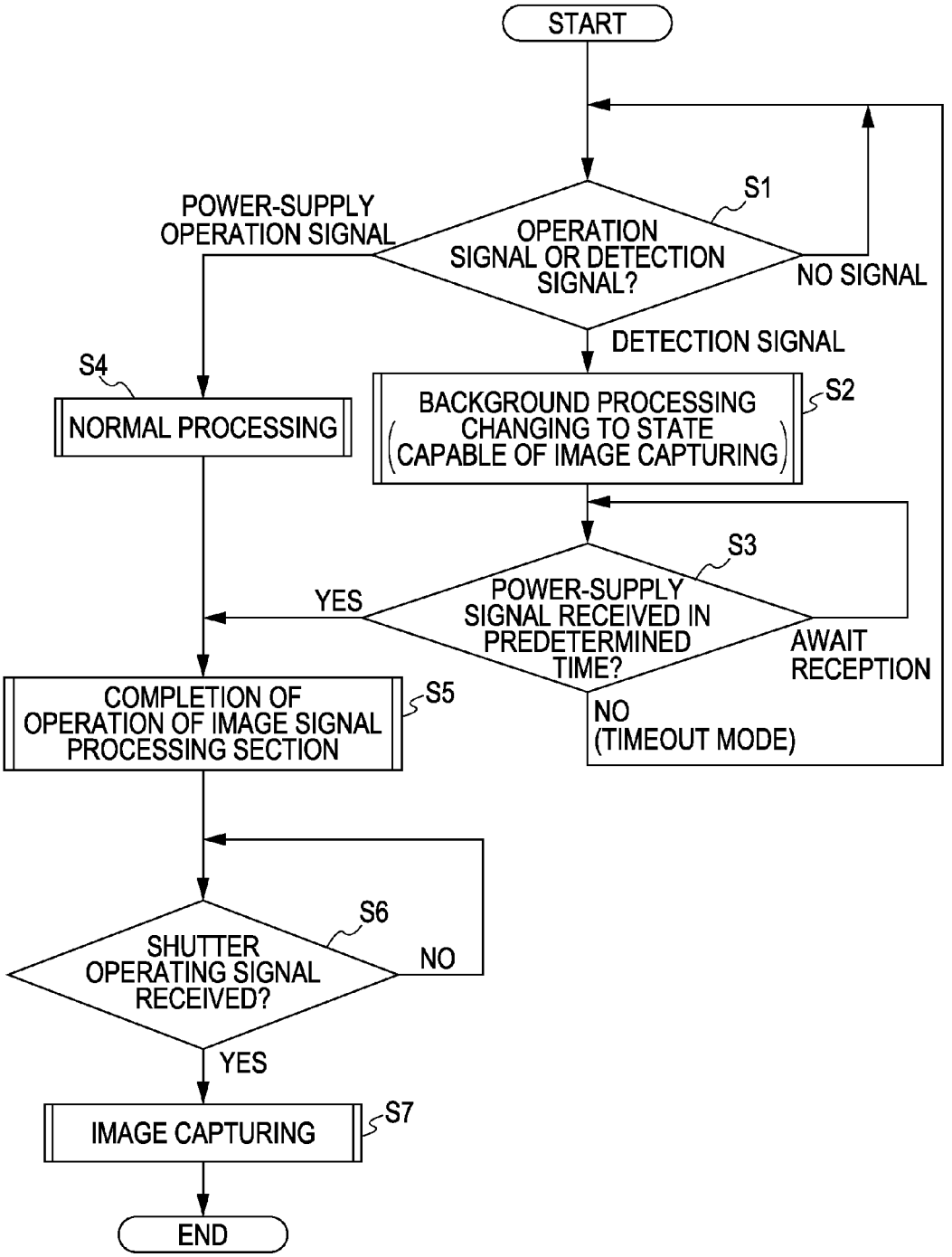

START
S1
POWER-SUPPLY OPERATION SIGNAL
OPERATION SIGNAL OR DETECTION SIGNAL?
NO SIGNAL
DETECTION SIGNAL
S4
NORMAL PROCESSING
BACKGROUND PROCESSING CHANGING TO STATE CAPABLE OF IMAGE CAPTURING
S2
S3
YES
POWER-SUPPLY SIGNAL RECEIVED IN PREDETERMINED TIME?
AWAIT RECEPTION
NO (TIMEOUT MODE)
COMPLETION OF OPERATION OF IMAGE SIGNAL PROCESSING SECTION
S5
S6
SHUTTER OPERATING SIGNAL RECEIVED?
NO
YES
IMAGE CAPTURING
S7
END

FIG. 7

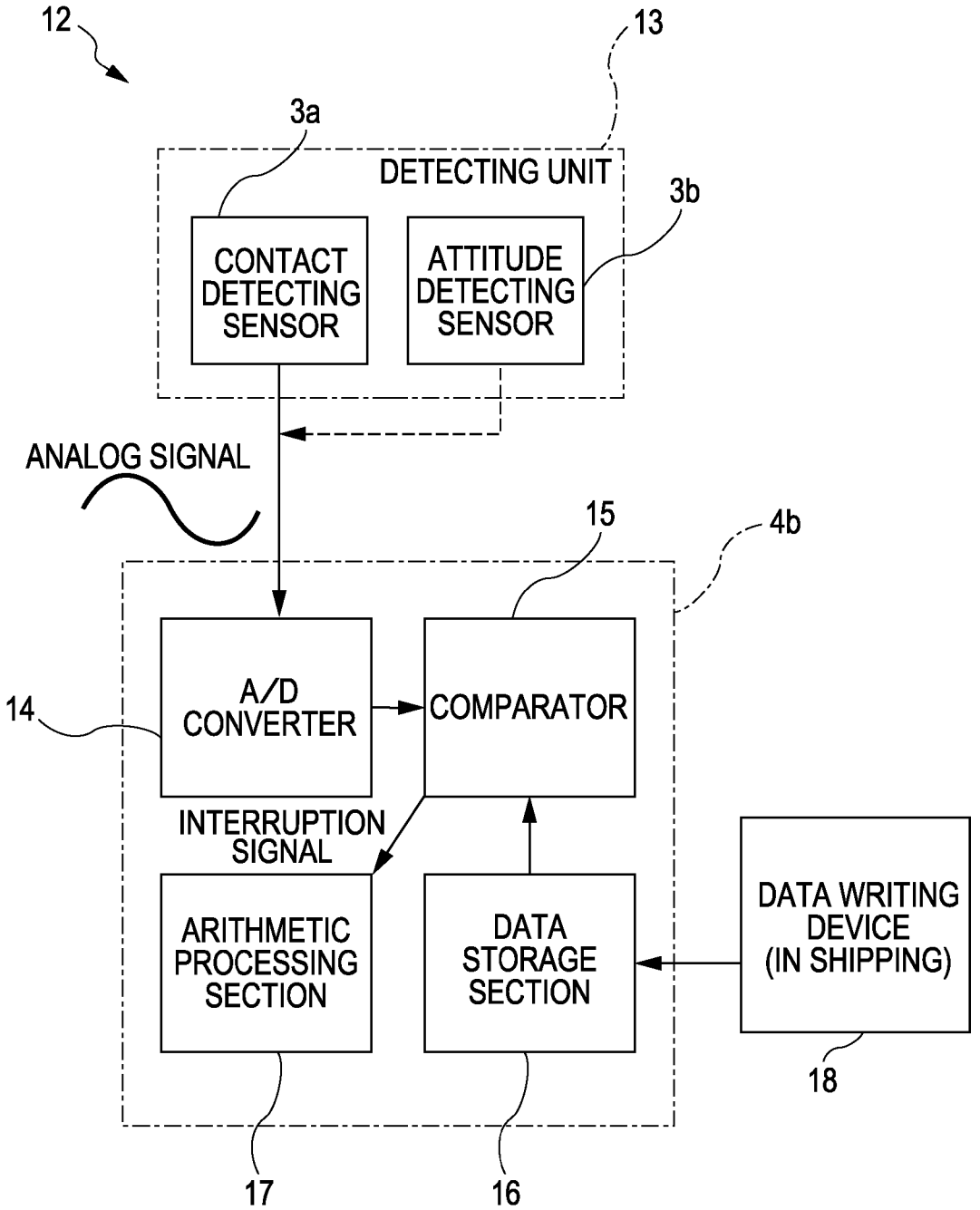

12
13
3a
DETECTING UNIT
3b
CONTACT DETECTING SENSOR
ATTITUDE DETECTING SENSOR
ANALOG SIGNAL
15
4b
14
A/D CONVERTER
COMPARATOR
INTERRUPTION SIGNAL
ARITHMETIC PROCESSING SECTION
DATA STORAGE SECTION
DATA WRITING DEVICE (IN SHIPPING)
18
17
16

FIG. 8

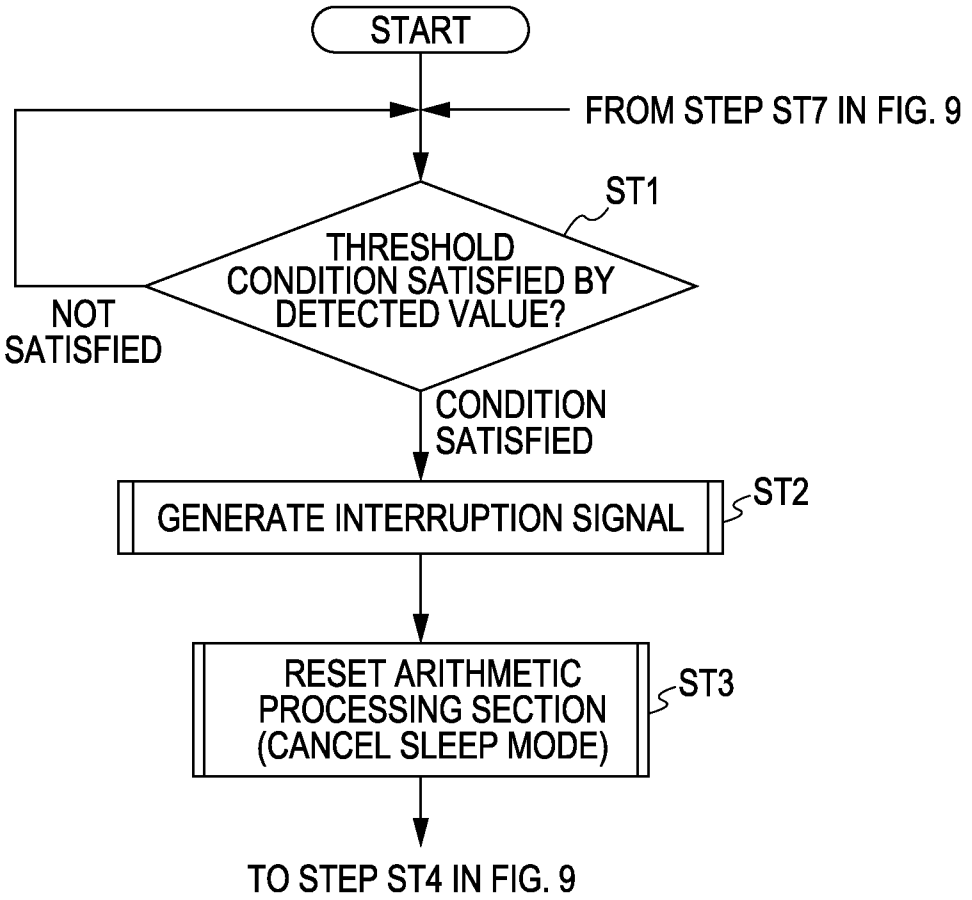

START
FROM STEP ST7 IN FIG. 9
ST1
THRESHOLD CONDITION SATISFIED BY DETECTED VALUE?
NOT SATISFIED
CONDITION SATISFIED
GENERATE INTERRUPTION SIGNAL
ST2
RESET ARITHMETIC PROCESSING SECTION (CANCEL SLEEP MODE)
ST3
TO STEP ST4 IN FIG. 9

FIG. 9

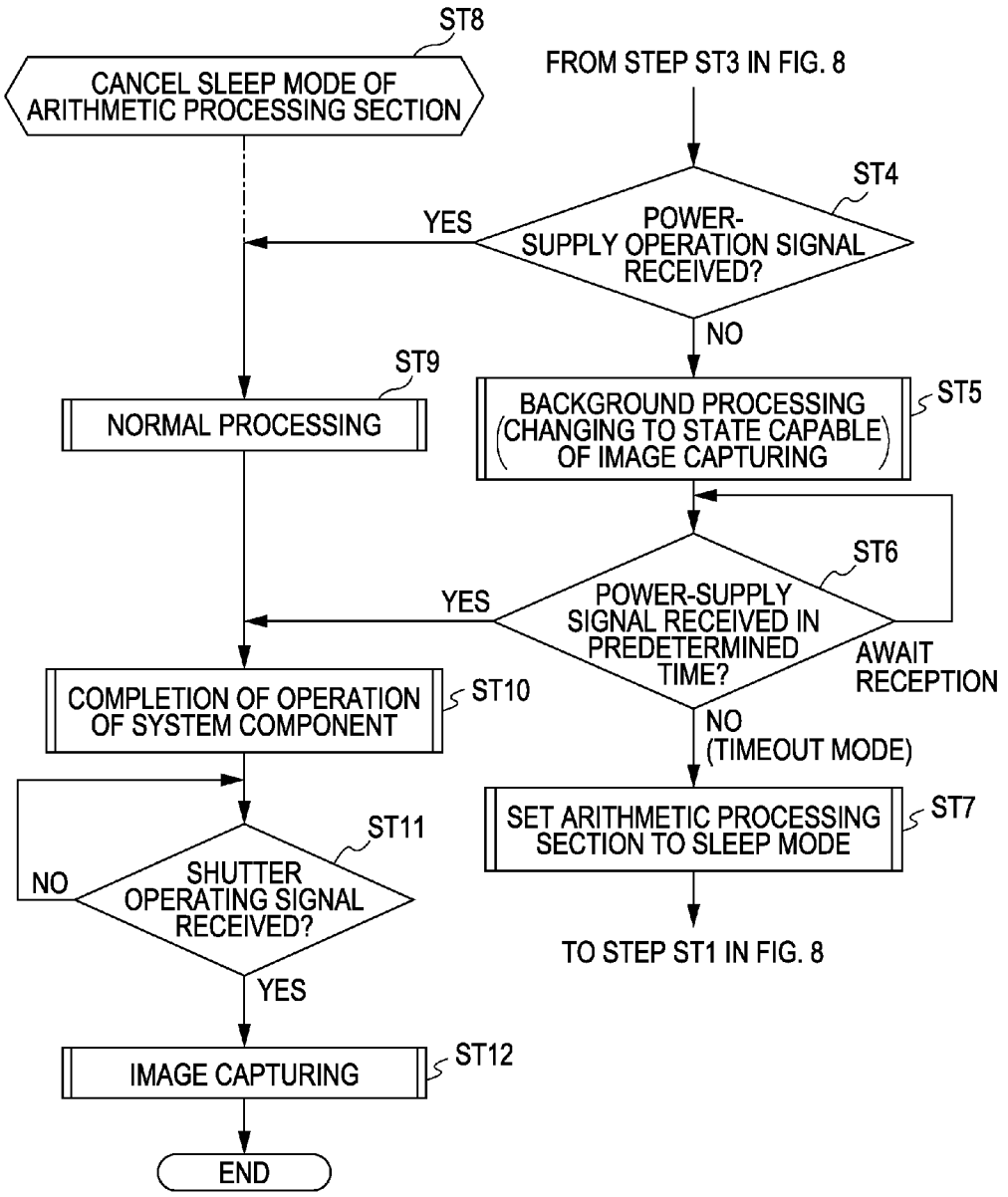

ST8
CANCEL SLEEP MODE OF ARITHMETIC PROCESSING SECTION
FROM STEP ST3 IN FIG. 8
ST4
YES
POWER-SUPPLY OPERATION SIGNAL RECEIVED?
NO
ST9
NORMAL PROCESSING
BACKGROUND PROCESSING (CHANGING TO STATE CAPABLE OF IMAGE CAPTURING
ST5
ST6
YES
POWER-SUPPLY SIGNAL RECEIVED IN PREDETERMINED TIME?
AWAIT RECEPTION
COMPLETION OF OPERATION OF SYSTEM COMPONENT
ST10
NO (TIMEOUT MODE)
SET ARITHMETIC PROCESSING SECTION TO SLEEP MODE
ST7
TO STEP ST1 IN FIG. 8
ST11
NO
SHUTTER OPERATING SIGNAL RECEIVED?
YES
IMAGE CAPTURING
ST12
END

FIG. 10

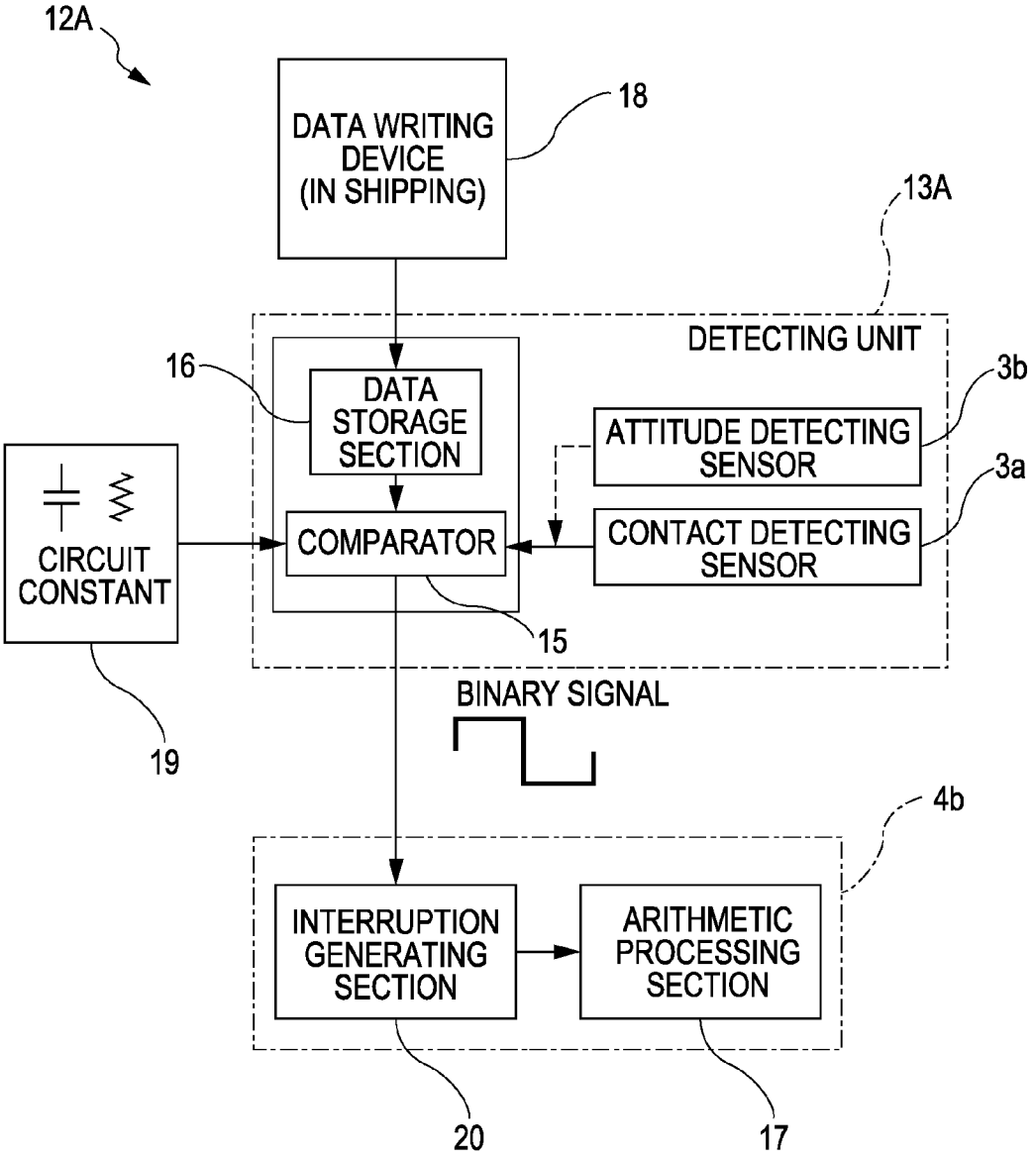

12A
DATA WRITING DEVICE (IN SHIPPING)
18
13A
DETECTING UNIT
16
DATA STORAGE SECTION
3b
ATTITUDE DETECTING SENSOR
3a
CONTACT DETECTING SENSOR
CIRCUIT CONSTANT
COMPARATOR
15
19
BINARY SIGNAL
4b
INTERRUPTION GENERATING SECTION
ARITHMETIC PROCESSING SECTION
20
17

FIG. 11

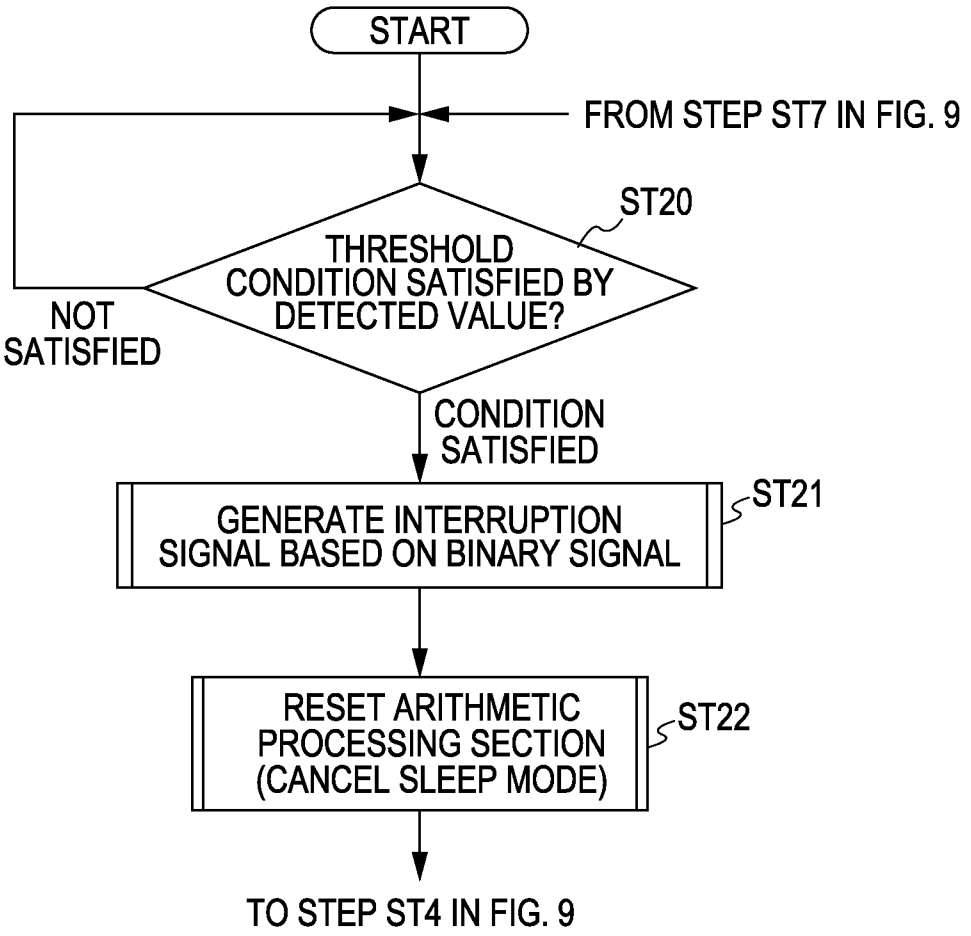

START
FROM STEP ST7 IN FIG. 9
ST20
THRESHOLD CONDITION SATISFIED BY DETECTED VALUE?
NOT SATISFIED
CONDITION SATISFIED
GENERATE INTERRUPTION SIGNAL BASED ON BINARY SIGNAL
ST21
RESET ARITHMETIC PROCESSING SECTION (CANCEL SLEEP MODE)
ST22
TO STEP ST4 IN FIG. 9

FIG. 12

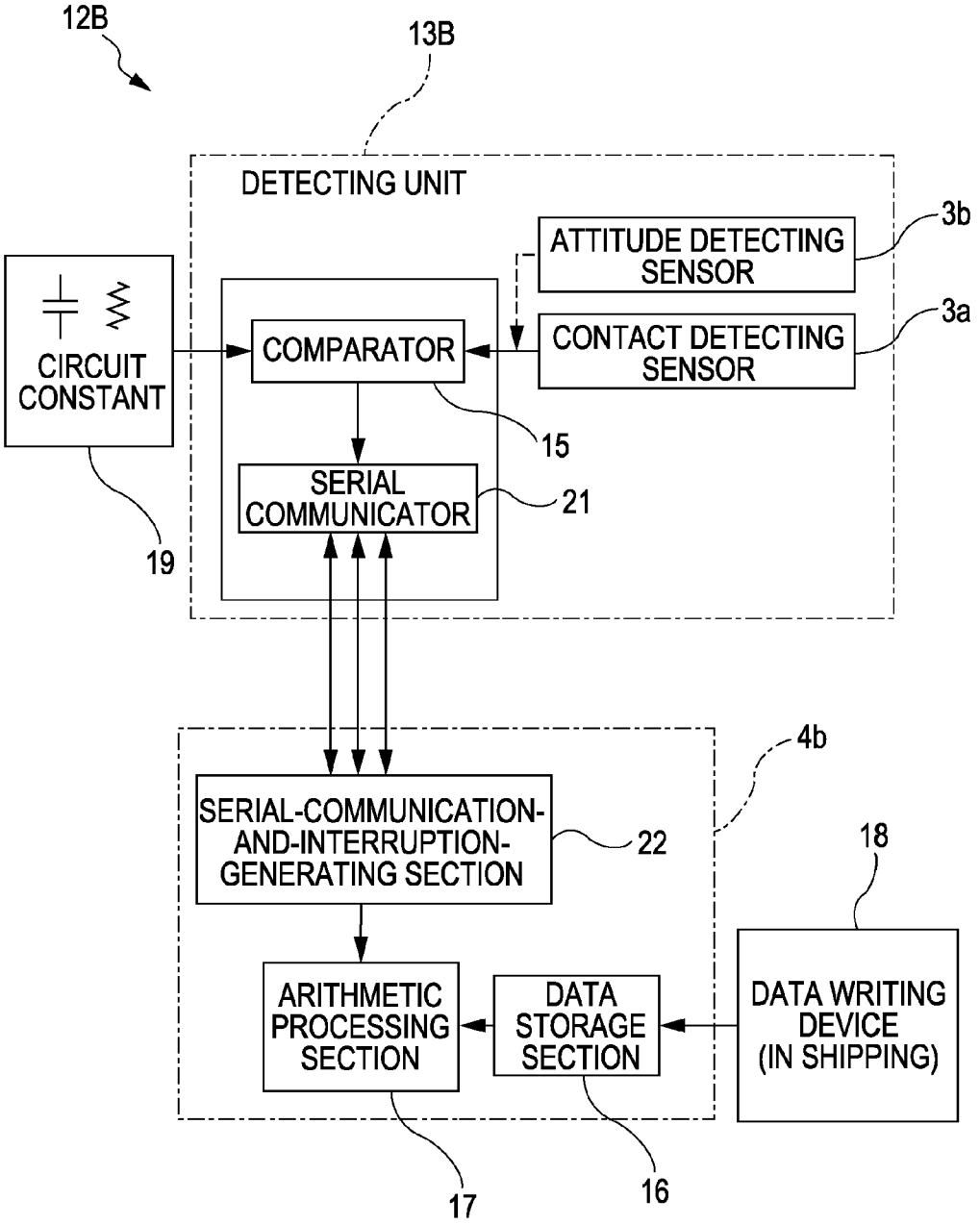
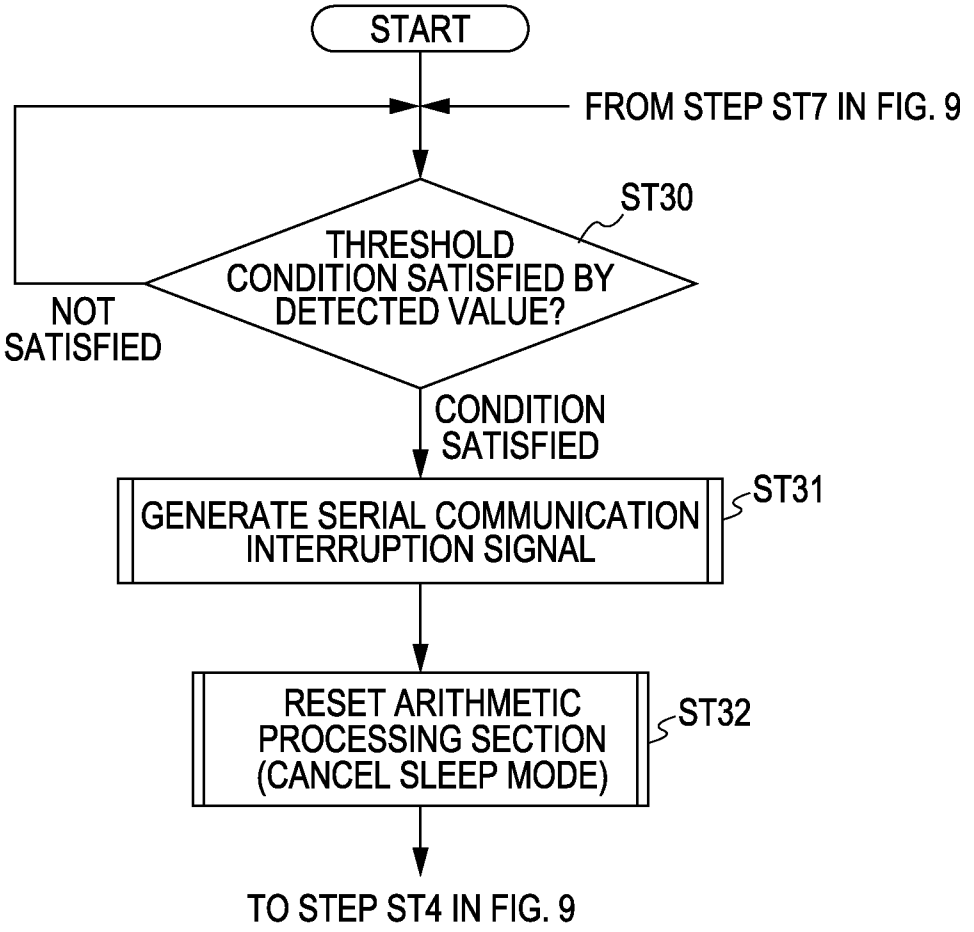

12B
13B
DETECTING UNIT
ATTITUDE DETECTING SENSOR
3b
CONTACT DETECTING SENSOR
3a
CIRCUIT CONSTANT
COMPARATOR
15
SERIAL COMMUNICATOR
21
19
4b
SERIAL-COMMUNICATION-AND-INTERRUPTION-GENERATING SECTION
22
18
ARITHMETIC PROCESSING SECTION
DATA STORAGE SECTION
DATA WRITING DEVICE (IN SHIPPING)
17
16

FIG. 13


START
FROM STEP ST7 IN FIG. 9
ST30
THRESHOLD CONDITION SATISFIED BY DETECTED VALUE?
NOT SATISFIED
CONDITION SATISFIED
GENERATE SERIAL COMMUNICATION INTERRUPTION SIGNAL
ST31
RESET ARITHMETIC PROCESSING SECTION (CANCEL SLEEP MODE)
ST32
TO STEP ST4 IN FIG. 9

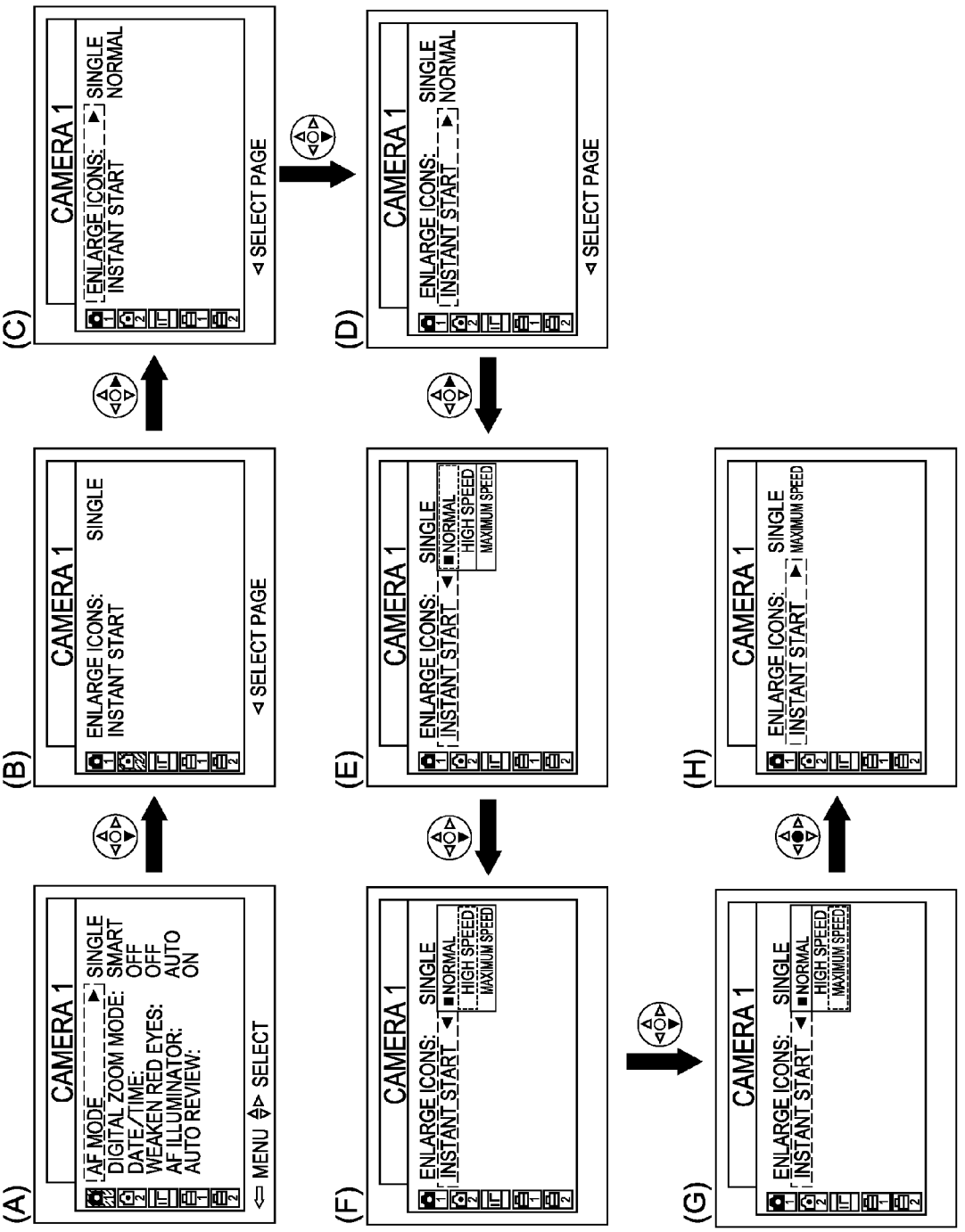

(A)
CAMERA 1
AF MODE SINGLE
DIGITAL ZOOM MODE: SMART
DATE/TIME: OFF
WEAKEN RED EYES: OFF
AF ILLUMINATOR: AUTO
AUTO REVIEW: ON
MENU SELECT
(B)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START
SELECT PAGE
(C)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START NORMAL
SELECT PAGE
(D)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START NORMAL
SELECT PAGE
(E)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START NORMAL
HIGH SPEED
MAXIMUM SPEED
(F)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START NORMAL
HIGH SPEED
MAXIMUM SPEED
(G)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START NORMAL
HIGH SPEED
MAXIMUM SPEED
(H)
CAMERA 1
ENLARGE ICONS: SINGLE
INSTANT START MAXIMUM SPEED

FIG. 14

FIG. 15

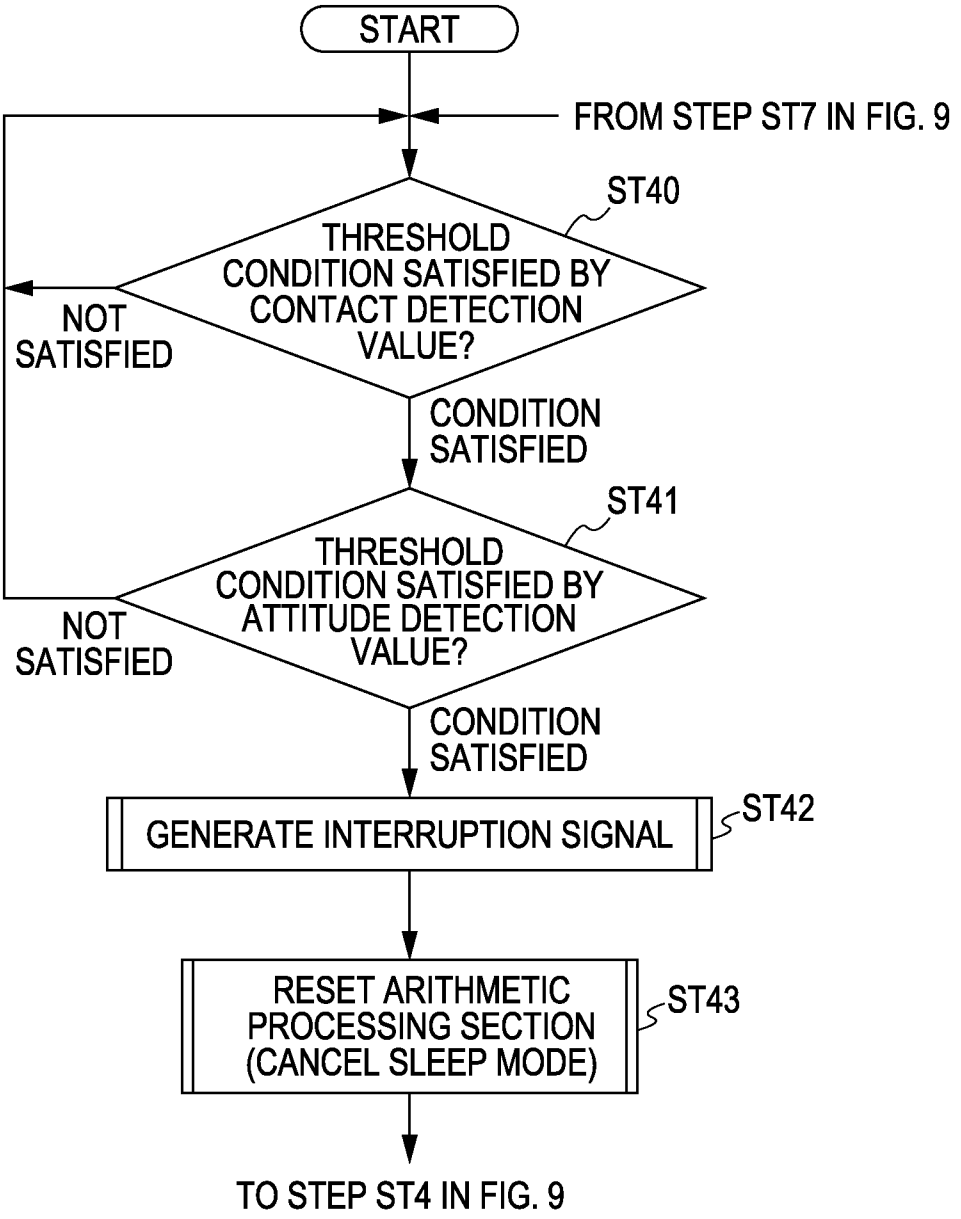

START
FROM STEP ST7 IN FIG. 9
ST40
THRESHOLD CONDITION SATISFIED BY CONTACT DETECTION VALUE?
NOT SATISFIED
CONDITION SATISFIED
ST41
THRESHOLD CONDITION SATISFIED BY ATTITUDE DETECTION VALUE?
NOT SATISFIED
CONDITION SATISFIED
GENERATE INTERRUPTION SIGNAL
ST42
RESET ARITHMETIC PROCESSING SECTION (CANCEL SLEEP MODE)
ST43
TO STEP ST4 IN FIG. 9

FIG. 16

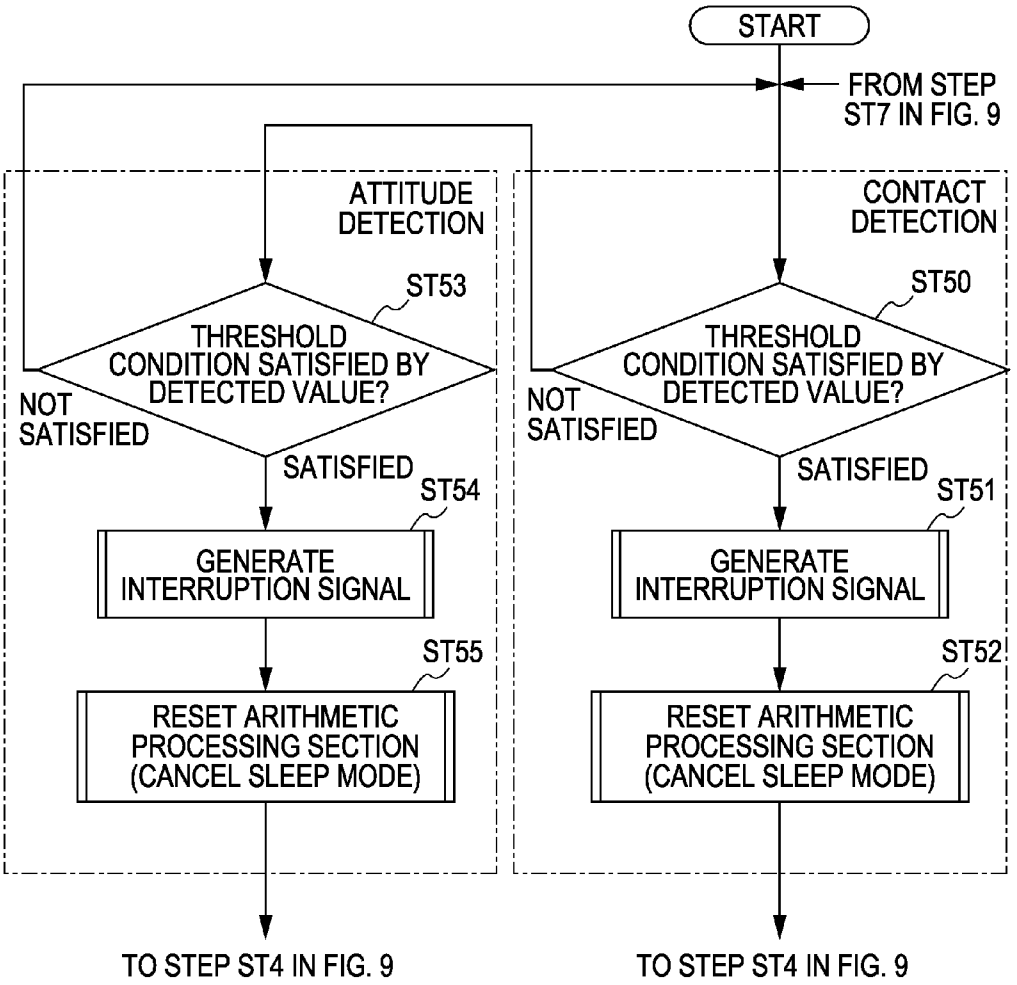

START
FROM STEP ST7 IN FIG. 9
ATTITUDE DETECTION
CONTACT DETECTION
ST53
THRESHOLD CONDITION SATISFIED BY DETECTED VALUE?
ST50
THRESHOLD CONDITION SATISFIED BY DETECTED VALUE?
NOT SATISFIED
NOT SATISFIED
SATISFIED
SATISFIED
ST54
GENERATE INTERRUPTION SIGNAL
ST51
GENERATE INTERRUPTION SIGNAL
ST55
RESET ARITHMETIC PROCESSING SECTION (CANCEL SLEEP MODE)
ST52
RESET ARITHMETIC PROCESSING SECTION (CANCEL SLEEP MODE)
TO STEP ST4 IN FIG. 9
TO STEP ST4 IN FIG. 9

IMAGE CAPTURING DEVICE AND ACTIVATION METHOD THEREFOR

CROSS-REFERENCES TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 13/531,967, filed on Jun. 25, 2012, which is a continuation of U.S. application Ser. No. 12/380,842, filed on Mar. 4, 2009, which is a continuation of U.S. application Ser. No. 11/434,542 filed on May 15, 2006 in the U.S. Patent and Trademark Office which claims priority from Japanese Patent Application No. JP 2005-142965 filed in the Japanese Patent Office on May 16, 2005, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates to a technology, used in an image capturing device, for enhancing its activating functionality so as not to fail to capture a desired image of a subject or the like and preventing unnecessary power consumption in a standby state of the image capturing device before it enters an image capturing mode.

A camera-device configuration (see, for example, Japanese Unexamined Patent Application Publication No. 2003-274640) is known which shortens an activation time that is necessary from the time a power-on operation is performed on a camera device until the camera device is actually switched on for use.

When a power supply switch is operated, chattering in which intermittent opening and closing of a contact is repeatedly performed occurs, thus causing a false operation, etc. Accordingly, after a time passes until effects of the chattering disappear, a process (so-called "chattering preventing process") that determines whether the power supply switch is opened or closed is performed. In addition, when it is determined that the power-on operation has been performed, a system initializing process is performed after power supplied by a system's power supply unit becomes stable. After that, the camera device is in a state capable of processing such as image capturing. In other words, it is difficult to perform an operation or processing desired by a user unless a time represented by "T**1**+T**2**+T**3**" passes after a power-supply operation time at which a power-supply operation is performed, where T**1** represents a time necessary for the chattering preventing process, T**2** represents a time necessary until the power supplied by the power supply unit becomes stable, and T**3** represents a time necessary for the system initializing process.

Therefore, by performing the chattering preventing process after turning on the power supply switch and the system initializing process in parallel, an activation time from the power-supply operation time until the operation or processing desired by the user is initiated can be shortened. In other words, by employing a sequence that performs system initialization as background processing for the chattering preventing process, after the power is supplied to the system, the system can be initialized without waiting for the chattering preventing process to finish. For example, when T**1**<T**3**, the activation time can be shortened to a time represented by "T**2**+T**3**" or approximately a time obtained by adding some value to "T**2**+T**3**."

However, the image capturing device of the related art has the following problems in its activating functionality and power saving function.

For example, cases in which the user misses a shutter release opportunity include a situation in which, when the power of the device is off at the time the user finds a desired subject, the user fails to capture an image of a subject due to a long time taken after the user holds the device until the device is ready for image capturing. In other words, a time necessary for activation after pressing the power supply switch is no more than approximately one second, even if the activation is fast, so that it is difficult to capture an image of a subject (or the like) passing in a moment. This is because it is difficult to reduce the activation time to zero in an actual device. To prevent the user from missing the shutter release opportunity, the system power needs to be continuously on or the device needs to be in a suspend state. The suspend state means a state in which, although an operation of a control unit such as a CPU (central processing unit) is stopped, the power of each portion of the system is on.

As described above, to reduce the activation time close to zero, an increase in power consumption is extremely important and necessary in compensation for the reduction. Therefore, when a battery-driven portable device is used, it is necessary for a user to carry many charged batteries or to use a mass storage battery. In a digital camera or the like, a device power-saving function is important for capturing as many images as possible. Thus, shortening of the activation time and the need of power saving conflict with each other.

Accordingly, it is desirable to satisfy both an improvement in activating functionality and power saving in an image capturing device.

SUMMARY OF THE INVENTION

To solve the above problems, according to an embodiment of the present invention, there is provided an image capturing device including first control means for controlling image capturing, the first control means having a first power consumption; operation means including a switch; detecting means for detecting a change to an image capturing mode and for sending a signal representing the change to the image capturing mode; second control means for monitoring and processing the signal sent from the detecting means, the second control means having a power consumption less than the first power consumption; and a power supply for supplying power to the first control means, the second control means, and a functional section of the image capturing device.

In the image capturing device, a power saving state is changed to a power supplying state capable of image capturing by supplying power from the power supply to portions of the image capturing device including the first control means when the second control means receives the signal representing the change to the image capturing mode from the detecting means.

According to another embodiment of the present invention, there is provided an activation method for an image capturing device having a function of controlling power supplying states including a first power control state capable of image capturing, the first power control state having a first power consumption, and a second power control state having a power consumption less than the first power consumption. The activation method includes, in the second power control state, monitoring a switch operation and a change to an image capturing mode; and, when the change to the image capturing mode is detected in the second power control state, changing the second power control state to the first power control state.

Accordingly, in an embodiment of the present invention, at the time a second control means receives a detection signal representing a change (changing start) to an image capturing

mode, power supply control for enabling image capturing is performed. After changing to a first power control state, image capturing is immediately initiated. In a second power control state, power is supplied only to the second control means and power does not need to be continuously supplied to the first control means and the second control means. This contributes to reducing power consumption in a standby state before image capturing.

According to an embodiment of the present invention, by initiating preparation for image capturing at the time the setting of an image capturing mode is detected, activating functionality can be enhanced. In addition, it is not necessary to set a power supplying state capable of image capturing at all times. When image capturing is not performed, by setting a standby state having low power consumption, a power saving effect can be obtained. In other words, since it is difficult to reduce an activation time itself to zero, by changing to the first power control state while using, as a start point, the time the change to the image capturing mode is detected, both an improvement in activating functionality and power saving can be achieved.

For example, after changing to a power supplying state capable of image capturing, when a power supplying operation is not performed, or a signal representing a change to an image capturing mode is not detected, by shutting off power supplied to the first power control means to change to the power saving state, power consumption in the standby state can be reduced. In other words, after changing to the first power control state, when a power supplying operation is not performed, or a signal representing a change to an image capturing mode is not detected, by determining that there is no intention of image capturing or a high probability of no intention, it is preferable to change to the second power control state (power saving state).

In addition, according to a configuration in which a sensor for detecting contact with a device is provided as the detecting means for detecting the change to the image capturing mode, when it is detected, as a preliminary image capturing step, that the image capturing device is touched by a user, the device can be changed to the first power control state. Alternatively, according to a configuration in which a sensor for detecting a change in the attitude of a body of the device is provided as the detecting means, when it is detected, as a preliminary image capturing step, that the image capturing device is held or moved by the user, the device can be changed to the first power control state. Furthermore, by employing a detecting form that is a combination of these sensors, detection accuracy can sufficiently be enhanced.

In order to obtain a power saving effect in a standby state in which image capturing is not performed, it is preferable that, when the second control means receives a signal representing a change to an image capturing mode from detecting means, a power-supply-instruction signal be sent from the second control means to a power supply after a resting state of the second control means is canceled.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing an example of a basic configuration of an image capturing device according to an embodiment of the present invention;

FIGS. **2**A and **2**B are perspective views showing contact detection in a camera according to an embodiment of the present invention;

FIGS. **3**A and **3**B are illustrations of a different example of the contact detection in a camera according to an embodiment of the present invention;

FIG. **4** is an illustration of attitude detection in a camera according to an embodiment of the present invention;

FIG. **5** is an illustration of examples of screens for activation settings;

FIG. **6** is a flowchart showing a system activating process;

FIG. **7** is a block diagram showing a main part of a configuration example;

FIG. **8** is a flowchart showing an example of an activation process;

FIG. **9** is a flowchart showing a process flow continued from FIG. **8**;

FIG. **10** is a block diagram showing a main part of another configuration example;

FIG. **11** is a flowchart showing a main part of an example of a system activation process concerning the configuration shown in FIG. **10**;

FIG. **12** is a block diagram showing a main part of still another example configuration;

FIG. **13** is a flowchart showing a main part of an example of a system activation process concerning the configuration shown in FIG. **12**;

FIG. **14** is an illustration of examples of settings for activation;

FIG. **15** is a flowchart showing a main part of an example of a system activation process in a case in which a high speed mode is set; and

FIG. **16** is a flowchart showing a main part of an example of a system activation process in a case in which a maximum speed mode is set.

DETAILED DESCRIPTION

In an embodiment of the present invention, by immediately controlling power supply when detecting setting of an image capturing mode with a detecting unit such as an electrostatic sensor or angular velocity sensor, image capturing can be initiated after necessary processing such as initialization. For example, at the time a user holds a camera, supplying of power to each portion of a camera system and an initializing process are initiated, whereby it takes almost no waiting time after operating a power supply switch until operating a shutter release button. This can prevent occurrence of a situation in which the user misses a shutter release opportunity. An embodiment of the present invention is widely applicable to still cameras and camcorders, or to various types of image capturing devices that can capture still and moving images.

FIG. **1** shows an example of a basic configuration of an image capturing device according to an embodiment of the present invention.

An image capturing device **1** includes an operation unit **2** including power supply switches and a detecting unit **3** using an electrostatic sensor, an angular velocity sensor, etc. Signals sent from these sensors are sent and processed in a system controller **4**.

The operation unit **2** includes various types of operation buttons and switches provided on the image capturing device **1**. In FIG. **1**, only power supply switches **2***a* and **2***b* are shown. An operation signal from a power supply switch (or a power switch) serves as a trigger signal for supplying power. When an embodiment of the present invention is applied to, for example, a digital still camera, the number of power supply switches is not limited to one depending on a configuration form, but there is a system including a plurality of power supply switches. In this embodiment, two switches are shown.

The detecting unit **3** is provided to detect a change in mode to an image capturing mode. The detecting unit **3** may have the following forms:

(I) form using sensor for detecting contact with image capturing device **1**;

(II) form using sensor for detecting change in attitude of image capturing device **1**; and

(III) form Using form (I) and form (II).

At first, in form (I), for example, a contact detecting sensor **3***a* such as an electrostatic sensor is used. The contact detecting sensor **3***a* detects contact of a user with the image capturing device **1**, and sends a signal of the detection to the system controller **4**. Excessive detection sensitivity causes a situation in which slight contact with the image capturing device **1** performs power supplying for activation, so that the frequency of false detection increases, etc. Thus, it is preferable to appropriately set the detection sensitivity to ensure contact detection.

Also in the above form (II), an attitude detecting sensor **3***b*, such as an angular velocity sensor or gyrosensor, is used. The attitude detecting sensor **3***b* detects a change in device attitude when the image capturing device **1** is held or moved by the user, and sends a signal of the detection to the system controller **4**. Cases to which an embodiment of the present invention is applied include a form in which, not only the angular velocity sensor, but also an acceleration sensor is used as a sensor capable of measuring a change in speed, and a form in which detection accuracy is enhanced by using a vibration sensor to increase the number of detection axes. Alternatively, in a camera device having an image stabilizing function, by using an angular velocity sensor and acceleration sensor provided for image stabilization to detect a change in device attitude, a detecting unit can be mounted without increasing the number of components and expense.

Improvement of the detection accuracy includes a method that uses a plurality of sensors of the same type in the above forms (I) and (II), and a method that uses sensors of different types in combination, as in form (III). When determination is multilaterally performed, the latter is more effective.

In FIG. **1**, for brevity of description, form (III) is assumed, and an example of the detecting unit **3** in which it includes sensors of plural types is shown. In addition, forms of transmission from the detecting unit **3** to the system controller **4** include analog transmission and digital transmission (including binarization communication and serial communication), whose details are described later.

The system controller **4** includes a first control unit **4***a* and a second control unit **4***b*. The configuration of the system controller **4** has, for example, the following forms:

a form in which each control unit is formed as a separate circuit; and

a form in which the system controller **4** is formed as a single chip and circuit portions having functions of both control units are formed in the single chip.

In either form, the first control unit **4***a* controls image capturing, or recording or playback of captured image data, and the second control unit **4***b* monitors and processes an operation input signal from the operation unit **2** and a detection signal from the detecting unit **3**. For example, a microcomputer or the like may be used as the first control unit **4***a*. For example, an application specific IC (integrated circuit), a microcomputer (used as a sub-computer for a main-computer used as the first control unit **4***a*), or the like, may be used as the second control unit **4***b*.

In a system configuration unit **5** under the control of the first control unit **4***a*, various types of components are used depending on the specifications and system configuration of the image capturing device **1**. In this embodiment, an image signal processing section **5***a* and an image display section **5***b* are shown as typical examples. The image signal processing section **5***a* includes an image capturing unit, a camera signal processor, and a recording-and-playback-system signal processor, and performs image capturing, and image recording and playback, and, in the image display section **5***b*, an LCD (liquid crystal display) panel or the like is used.

A power supply **6** supplies power to the first control unit **4***a*, the second control unit **4***b*, and the system configuration unit **5**. In application of an embodiment of the present invention, a power supply **6***a* in which, for example, a battery (primary battery or secondary battery), a fuel cell, or the like, is used, and a power-supply voltage generating section **6***b* (such as a DC-DC converter) for generating a power-supply voltage necessary for each circuit are provided irrespective of the circuit configuration of the power supply **6**. The power-supply voltage generating section **6***b* supplies power to each circuit through power-supply lines.

In this embodiment, when the power supply **6***a* supplies power to the power-supply voltage generating section **6***b* in a state in which a battery pack or the like is installed in the image capturing device **1**, power supply from the power-supply voltage generating section **6***b* to the second control unit **4***b* can be immediately performed.

The second control unit **4***b* has power consumption less than that of the first control unit **4***a*. This is because, since the second control unit **4***b* handles monitoring and processing the operation signal and the detection signal, unnecessary power consumption is prevented in a standby state before image capturing. When, for example, a microcomputer is used as the second control unit **4***b*, a consumption current is set to hundred microamperes or less.

Unlike that, an arithmetic operation unit having a fixed operating frequency, or an arithmetic operation unit in which power control can be performed by variably controlling an operating frequency is used as the first control unit **4***a*. When acceleration of processing or the like is preferentially performed, the power consumption of the first control unit **4***a* increases than that of the second control unit **4***b*. In other words, if the image capturing device **1** is set in a mode capable of image capturing at all times by performing a power-supply operation (by the user) to supply power to the first and second control units **4***a* and **4***b*, and the system configuration unit **5**, a situation in which the user misses a shutter release opportunity can be avoided. However, power consumption in the above case is large, thus shortening a time in which the image capturing device **1** can be battery-driven. Accordingly, in the standby state before image capturing, by supplying power from the power supply **6***a* to the second control unit **4***b* having less power consumption, a power saving effect can be obtained.

In an embodiment of the present invention, in a power saving mode in which power is supplied from the power supply **6***a* to the power-supply voltage generating section **6***b*, when the second control unit **4***b* receives, from the detecting unit **3**, a signal representing a change in mode to the image capturing mode, the power supply **6** supplies power to the first control unit **4***a* and the system configuration unit **5**, and the power saving mode subsequently changes to a power supplying state capable of image capturing. Specifically, power control states of the image capturing device **1** include at least the following states:

a first power control state (hereinafter referred to as "1S") in which the image capturing device **1** is capable of image capturing; and

a second power control state (hereinafter referred to as "2S") having power consumption less than that in 1S.

In 1S, power supply from the power supply **6** to the system controller **4** and the system configuration unit **5** is performed, so that power consumption is greater than that in 2S.

Also, in 2S, power supply from the power supply **6** to the second control unit **4***b* is performed and power supply to the first control unit **4***a* and the system configuration unit **5** is not performed. In other words, 2S is a power saving state which monitors a switch operation by the operation unit **2** and a change in mode to the image capturing mode by the detecting unit **3**. When the change in mode to the image capturing mode is detected in this control state, that is, when a detection signal by the detecting unit **3** is sent as a trigger signal to the second control unit **4***b*, control of change from 2S to 1S is performed.

This performs power supplying to the first control unit **4***a* and initialization, power supplying to the system configuration unit **5**, etc. After that, the image capturing device **1** changes to the power supplying state capable of image capturing. In this state, by turning on the power supply switch and pressing a shutter release button, image capturing can be instantly initiated. In addition, in 1S, when the power-supply operation by the power supply switch is not performed, or the signal from the detecting unit **3** which represents the change in mode to the image capturing mode is not received, 1S automatically changes into 2S. In other words, by shutting off supplying the power to the first control unit **4***a* and the system configuration unit **5**, 1S changes into the power saving state (2S).

For brevity of description, in only 1S, the image capturing can be performed. However, in application to a configuration form in which a power saving effect can be set in stages or continuously by operating frequency control or device power-supplying control, the power control state can be divided depending on the level of the power consumption. Specifically, 1S can be divided into two or more classes.

Although, in this embodiment, a configuration in which the operation signal with the power supply switch **2***a* is sent and processed in the second control unit **4***b* has been described, the embodiment of the present invention can be practiced in various configurations such as a configuration in which the operation signal from the power supply switch **2***a* is sent and processed in the first control unit **4***a*.

Next, an example of a power-supply control sequence of the image capturing device **1** is described below, with it divided into the following three cases:

(a) case A in which, after detecting that the image capturing mode is set, the power supply switch **2***a* is operated by the user to initiate image capturing;

(b) case B in which, although it is detected that the image capturing mode is set, the power supply switch **2***a* is not operated by the user after that; and

(c) case C in which detection of the image capturing mode in being set and a user's operation on the power supply switch **2***a* are performed approximately at the same time.

At first, case A is described in accordance with the following steps (1) to (7). In FIG. **1**, the numerals in the parenthesized symbols correspond to the following parenthesized numerals 1 to 7, respectively, and represent processing order with the lapse of time.

(1) By inserting a battery into the power supply **6**, the power of the power-supply voltage generating section **6***b* is turned on.

(2) Power supply from the power-supply voltage generating section **6***b* to the second control unit **4***b* is performed, whereby the second control unit **4***b* is ready to receive the operation signal from the power supply switch **2***a*.

(3) The second control unit **4***b* is notified by the detecting unit **3** that the image capturing device **1** is in the image capturing mode. For example, in form (I), an electrostatic sensor or the like is used for detecting contact with the image capturing device **1**. In other words, detection of contact with the image capturing device **1** by using the sensor performs system activation. For example, a system activation process is performed as a background process. In addition, in form (II), an angular velocity sensor or the like is used for detecting a change in attitude of the image capturing device **1**. Detection with the sensor of a state in which the image capturing device **1** is raised by the user and is ready for image capturing, system activation is performed. For example, a system activation process is performed as a background process.

When receiving, from the detecting unit **3**, a signal indicating that the image capturing mode is set, the second control unit **4***b* instructs the power-supply voltage generating section **6***b* to perform power supply to the first control unit **4***a* and the system configuration unit **5** by sending a signal to the power-supply voltage generating section **6***b*.

(5) After being instructed by the second control unit **4***b*, the power-supply voltage generating section **6***b* initiates supplying power to the entire system. In other words, power is supplied to the first control unit **4***a* and the system configuration unit **5**.

(6) When the entire system is sufficiently supplied with power, each component is operable, thus enabling signal transfer between the first control unit **4***a* and the second control unit **4***b*, and signal transfer between the first control unit **4***a* and each of the image signal processing section **5***a* and image display section **5***b* of the system configuration unit **5**.

(7) When the power supply switch **2***a* is operated by the user, a signal of the operation is transferred to the second control unit **4***b*. The signal is transferred from the second control unit **4***b* to the first control unit **4***a*, so that the image capturing device **1** instantly changes into a state capable of initiating image capturing.

In this embodiment, when the detecting unit **3** detects that the image capturing mode is set in the image capturing device **1**, power can be supplied to the components including the first control unit **4***a* in such a manner that the second control unit **4***b* instructs the power-supply voltage generating section **6***b*. However, the sequence is not limited thereto, but may employ a method in which the system is set to a suspend state before image capturing and a method in which the operating speed of the first control unit **4***a* is reduced. In this case, when the detecting unit **3** detects that the image capturing mode is set in the image capturing device **1**, the system is returned to a state capable of image capturing, or an increased operating speed of the first control unit **4***a* sets the image capturing device **1** to be in an image capturing state without any difficulty. Hence, although a time necessary for system activation is shortened, in the standby state in which it is not detected that the image capturing mode is set, power consumption increases compared with the above case.

Next, although, in case B, for example, when the user touches the image capturing device **1** but does not press any power supply switch, the steps (1) to (6) are performed, power is consumed more than necessary if the system is being activated in this state. Accordingly, when the power-supply operation is not performed, or the signal from the detecting unit **3** that represents a change in mode to the image capturing mode is not set, the present state is changed to the above 2S (power saving state). For example, in cases such as when a detection signal representing a touch of the user on the image capturing device **1** is not sent to the second control unit **4***b* during a predetermined time, power to the first control unit **4***a*

and the system configuration unit **5** is shut off without any explicit operation instruction. For example, supplying of power to the portions of the system excluding the second control unit **4***b* is stopped in the background processing without notifying the user. In this state, under the control of the second control unit **4***b*, the image capturing device **1** is set in a mode that monitors an operation signal and a detection signal. The power consumption is at a minimum level that is necessary for processing by the second control unit **4***b*. After that, when a touch of the user on the image capturing device **1**, that is, the image capturing mode in being set in the image capturing device **1**, the process proceeds from step (3) to step (4) and thereafter.

In case C, for example, when a state in which the user touches the image capturing device **1** and a state in which the user presses the power supply switch occur simultaneously or approximately simultaneously, the system activating process is performed as in the related art, and the image capturing mode is set in the image capturing device **1** without any difficultly. In other words, in a configuration form in which the second control unit **4***b* continuously monitors an operation signal and a detection signal, the start of changing to the image capturing mode is detected by the detecting unit **3**, and, even if the power supply switch **2***a* is simultaneously pressed, both can be grasped by the second control unit **4***b*. Thus, after changing "7" in the parenthesized symbol in FIG. **1** to "3," processing after the above (4) is performed.

When the start of changing to the image capturing mode is not detected at all, for example, when the user does not touch the image capturing device **1** in form (1), in the above (3), a detection signal indicating that the image capturing mode is set in the image capturing device **1** is not sent to the second control unit **4***b*. Thus, system activation, that is, supplying power to the first control unit **4***a*, an initializing process, and supplying power to each portion of the system configuration unit **5** are not performed (the image capturing device **1** enters a power-controlled state in which the power consumption is the lowest).

Although various states depending on usage of the image capturing device **1** are assumed, the second control unit **4***b* sets power management and a power control sequence, whereby, in any state, the image capturing device **1** can be changed to a state capable of image capturing by activating the system without any difficulty.

FIGS. **2**A to **16** show an example in which an embodiment of the present invention is applied to a digital camera or the like.

FIGS. **2**A and **2**B show, as an example of form (I), an example of a configuration using an electrostatic sensor or the like. FIG. **2**A is a perspective view of a camera **7**, and FIG. **2**B is a perspective back view of a front portion **8***a* of a camera housing **8**.

In this embodiment, an image capturing portion **9** is provided on the front portion **8***a*, and in the front portion **8***a*, the contact detecting sensor **3***a*, such as an electrostatic sensor, is embedded in an area in which user's fingers touch a back side in the image capturing mode.

In this case, it is important to know contact of the user's fingers without false detection. In other words, excessively enhancing the sensitivity of a sensor IC (or the like) mistakenly detects approach of a part of a human body other than the fingers.

Accordingly, it is preferable to lower the sensor sensitivity and it is preferable to broaden a sensor-detecting area, that is, an area for sensing a touch of the user. For example, an amount of detection (electrostatic amount) obtained when the user's fingers touch the area is stored and, when the amount of detection exceeds a predetermined threshold value, it can be determined that the amount of detection represents the start of changing to the image capturing mode. When the amount of detection is equal to or less than the threshold value, it can be determined that the amount of detection represents unexpected contact or approach, or the like.

This embodiment has no problem when a housing is made of, for example, synthetic resin such as plastic. The housing may be coated with an electrostatic shield depending on a device form, and it is difficult to uses the electrostatic sensor to detect contact.

In such a case, a configuration in which, as shown in FIG. **3**A, the contact detecting sensor **3***a* is embedded in a surface of a portion that the user's fingers touch, for example, the front portion **8***a*, is employed, and a configuration in which, as shown in FIG. **3**B, the contact detecting sensor **3***a* is embedded in a back portion **8***b*, in which a display portion **10** and an operation portion **11** are provided, is employed. For example, an electrically conductive film element may be used as a detecting element. However, the detecting element is not limited to the film element but a detecting element formed of various electrically conductive materials may be used.

FIG. **4** shows, as an example of form (II), an example of a configuration using a triaxial acceleration sensor.

In a camera **7**B in this example, an attitude detecting sensor **3***b* that is provided on a front portion **8***a* or a back side thereof detects changes in X, Y, and Z axes shown in FIG. **4**. In other words, user's entering the image capturing by holding the camera **7**B is detected as a change in speed caused by a change in attitude, that is, acceleration.

The configuration is not limited to the use of the triaxial sensor but a biaxial angular velocity sensor or the like may be used. In addition, an angular velocity sensor and acceleration sensor for detecting motion blurring may also be used. The more the number of axes for detection is, the higher accuracy the detection can have. However, considerations, such as reserving an installation space and an increase in cost, are necessary.

Next, an example of settings concerning system activation is described in accordance with examples of screens shown in portions (A) to (G) of FIG. **5**. Although applying an embodiment of the present invention is irrelevant to a system activation setting method, places for settings, etc. In the following examples, a case in which a new item (hereinafter referred to as "INSTANT START") is added to a setting screen displayed on a display portion is described below.

Portion (A) of FIG. **5** shows a screen displayed at the time of changing to a setup screen. A range indicated by the broken line rectangle indicates an item being presently selected by a user.

When the user uses an operation portion (see, for example, the operation portion **11** shown in FIG. **3**B), such as a cross key, to perform a "downward" operation, a selected position of an indicator (icon) on a left tool bar downwardly moves, and the screen displayed in portion (B) of FIG. **5** is displayed. In part of the screen on the right side of the indicator, the item "INSTANT START" is displayed.

When the user uses the operation portion, such as the cross key, to perform a "right directional operation" while intending to select "INSTANT START," as shown in portion (C) of FIG. **5**, the item "ENLARGE ICONS" at the top of a main part of the screen is selected. However, what the user intends to select is not the item. Accordingly, by using the cross key to perform a "downward" operation, as shown in portion (D) of FIG. **5**, the cursor is moved to the item "INSTANT START" (this item is set to "NORMAL" in this example).

When the user operates the "right" directional operation in a state in which the cursor is positioned at the item "INSTANT START," as shown in portion (E) of FIG. **5**, it can be selected whether to enable (see "ON" in portion (E) of FIG. **5**) or disable (see "OFF" in portion (E) of FIG. **5**) the setting of "INSTANT START."

Since, in this example, the item has been set to "OFF," the user uses the cross key to perform the "downward" operation. In this operation, as shown in portion (F) of FIG. **5**, the setting can be enabled, that is, the cursor can be positioned at "ON."

When the user intends to confirm the selected item, that is, the item "INSTANT START" needs to be set to "ON," by pressing a center portion (determination button) of the cross key, the screen displayed in portion (G) of FIG. **5** is displayed and the setting operation finishes.

These consecutive operations can set the item "INSTANT START" to be enabled ("ON").

Although, in this example, in selecting "INSTANT START," its enabling or disabling is displayed with a name of "ON" or "OFF," obviously, the name, settings, etc., can be freely altered in accordance with an application design. In addition to a form in which item setting is performed on the setup screen, enabling in various configurations is possible such as a configuration provided with a dedicated toggle button and a configuration in which, by providing a contact detecting unit, such as a touch panel, on a display surface, a desired item can be selected on a screen by the user.

FIG. **6** is a flowchart illustrating the system activating process.

In step **S1**, it is determined whether or not an operation signal from a power supply switch or a detection signal from a contact detecting sensor or attitude detecting sensor has been sent to the system (see, the second control unit **4***b* in FIG. **1**). If the operation signal or the detection signal has been sent, the process proceeds to step **S2** or **S4**. If not, monitoring the operation signal or the detection signal is continued (this state corresponds to the control state 2S and the power saving mode is set).

When changing to the image capturing mode is predicted on the basis of the detection signal, the process proceeds to step **S2** and supplying power to the system controller **4** and a system configuration unit and initialization are initialized as background processing. In addition, in a predetermined time, for example, within one second), a state capable of image capturing is set (this state corresponds to the control state 1S), and the process proceeds to step **S3**.

When a power-supply instruction is issued by operating an operation switch, the process proceeds to step **S4**, and the system activation process is normally performed (this is similar to that in the related art) before the process proceeds to step **S5**.

In step **S3**, it is determined whether or not the operation switch has been operated within a predetermined time. In addition, when the power-supply instruction has been issued before a predetermined set time passes, the process proceeds to step **S5**. Even if the set time has passed (at timeout), when the power-supply instruction has not been issued, the process returns to step **S1**. Determination of whether the operation signal from the operation switch has been sent is performed until the set time passes.

In step **S5**, an operation of the system configuration unit, for example, the image signal processing section **5***a*, is completed, and a backlight or the like included in the image display section **5***b* emits light to display a screen.

It takes almost no time from the time the power supply switch is performed in step **S3** until changing to step **S5** is performed. In other words, instantly after the user operates the power supply switch, image capturing preparation is established.

Processing to step **S6**, it is determined whether or not an image-capturing-instruction signal has been sent to the system by pressing a shutter release button. If the image-capturing-instruction signal has been sent to the system, the process proceeds to step **S7** and an image capturing process is initiated.

When, in step **S1**, both the operation signal from the power supply switch and the detection signal from the sensor are approximately simultaneously input, for example, the operation signal from the power supply switch is preferentially used and the process proceeds to **S4**.

This example has a feature in processing path proceeding from step **S1** in the order of "steps **S2**, **S3**, and **S5**." In a configuration of the related art, even if, in step **S1**, the power supply switch is operated so as not to miss capturing an image of a subject, it is difficult for the process to proceed to step **S5** unless the waiting time in step **S4** passes. Accordingly, a situation in which a shutter release opportunity is missed during that time occurs.

Next, an example of a configuration in which a signal detected by using an electrostatic sensor or angular velocity sensor concerning changing to the image capturing mode is sent to the system controller **4** is described.

Transmitting forms for using the angular velocity sensor or the like to notify the system that the user holds and sets a camera to be ready for image capturing include, for example, the following systems:

(1) analog system; and

(2) digital systems:

(2-1) binarization system; and

(2-2) serial system.

Comparisons in power among the systems are represented by "the (1) analog system">"the (2-2) serial system"≥"the (2-1) binarization system." As is clear, the digital systems are less in power consumption than the analog system. This is because power is increased for reasons such as the need to cause an A/D converter to operate. In addition, in the binarization system, detection in the system is simple since two signal levels, High and Low, are used. Accordingly, it has an advantage in that, in a state in which image capturing is not performed, the system is continuously set in a sleep mode.

FIG. **7** is a block diagram showing a configuration example **12** in the (1) analog system, and shows a detecting unit **13** and the second control unit **4***b* in the system controller **4**.

In the detecting unit **13**, for example, an electrostatic sensor serving as a contact detecting sensor **3***a*, an angular velocity sensor serving as an attitude detecting sensor **3***b*, etc., are used, and each sensor output is sent as an analog signal to an IC or computer forming the second control unit **4***b*.

The second control unit **4***b* includes, in its circuit configuration, an A/D converter **14**, a comparator **15**, an arithmetic processing section **17** (such as a CPU (central processing unit) core, or an ASIC (application specific IC)).

The A/D converter **14** receives and converts the analog signal from the detecting unit **13** into a digital signal, and sends the digital signal to the comparator **15**.

In a data storage section **16**, threshold data to be sent to the comparator **15** is stored by using a data writing device **18**. As the data storage section **16**, for example, a nonvolatile storage device, such as an EEPROM (electronically erasable and programmable read only memory), is used. By writing threshold data in shipping in units of devices, a problem of detection error caused by variation in sensor characteristics and device-unique variation in production, malfunction, or

the like, can be prevented (reliability is enhanced compared with a case using the same threshold data at all times). In addition, forcing surface mounted components to be changed after a product is completed needs a component cost and time, thus causing a production cost. However, ability to use software processing with a CPU to alter set values or the like by writing data to the nonvolatile storage device produces an advantage in that, even after hardware is completed, adjustment, setting alternation, etc., can be freely performed. In addition, by describing conditional branching in a program concerning ambient environments such as an outside air temperature, flexible responses can be performed.

Threshold data read from the data storage section **16** is sent to the comparator **15** and is compared with data (sensor detection data) digitized by the A/D converter **14**. When the detection data satisfies a condition represented by the threshold data, it is recognized that, for example, the user touches a predetermined area of the camera, or changing to the image capturing mode is initiated such that the user holds the camera, and an interruption signal to the arithmetic processing section **17** is generated. In addition, when the detection data does not satisfy the condition represented by the threshold data, it is determined that the image capturing mode is not set, or temporary or accidental contact or change in attitude or disturbance such as noise occurs.

In response to the interruption signal from the comparator **15**, a sleep state of the CPU core forming the arithmetic processing section **17** is canceled (wakeup), and a system operation is performed with original performance that can be exhibited.

Detection data sampling may be performed in a wakeup state at all times without setting the CPU core or the like to be in the sleep state, but power consumption at that time is an issue. In other words, when power consumed for a continuous operation of the CPU core, ASIC, or the like, is an issue, it is preferable to sufficiently lower the operating frequency, or it is preferable to set the CPU core or ASIC to the sleep state or a resting state so that power consumption is set to a value close to almost zero. However, since it is not allowed to stop supplying power to the A/D converter **14**, the comparator **15**, and the data storage section **16**, minimum power at which comparison operations between data converted by the A/D converter **14** and the threshold data read from the data storage section **16** is guaranteed is consumed at all times. In other words, the second control unit **4***b* consumes only minimum necessary power in its standby state, and, when the second control unit **4***b* receives a signal representing changing to the image capturing mode from the detecting unit **13**, the second control unit **4***b* cancels its resting state and sends a power-supply-instruction signal to a power supply. By performing an intermittent operation to such an extent that detection is prevented from failing, the power consumption can be reduced.

FIGS. **8** and **9** are flowcharts showing an example of a system activation process concerning the (1) analog system.

At first, in step ST**1** in FIG. **8**, after an analog signal is sent from the detecting unit **13** to the A/D converter **14**, a digital signal obtained in conversion by the comparator **15** is sent to the comparator **15**. In addition, threshold data is sent from the data storage section **16** to the comparator **15**, and both are compared by the comparator **15**. If the detection data satisfies a condition defined by the threshold data, the process proceeds to step ST**2**. If not, the detection is continuously monitored.

In step ST**2**, the comparator **15** generates an interruption signal for the arithmetic processing section **17**, and, in the next step, the sleep state is canceled. In other words, the process proceeds to step ST**3**, and a state in which the arithmetic processing section **17** can perform processing with a predetermined operating speed. The process proceeds to step ST**4**.

In step ST**4**, it is determined whether or not the operation signal from the power supply switch has been sent to the second control unit **4***b*. If the operation signal has not been sent, the process proceeds to step ST**5**. If the operation signal has been sent, the process proceeds to step ST**9**.

In step ST**5**, supplying power to the system controller and the system configuration unit, initialization, etc., is initiated so as not to be noticed by the user (background processing). The device becomes ready for image capturing within a predetermined time, and the process proceeds to step ST**6**.

In step ST**6**, it is determined whether or not an operation on the power supply switch has been performed within a predetermined time. When a power-supply instruction is issued before a predetermined set time passes, the process proceeds to step ST**10**. Even if the set time has passed, when the power-supply instruction is not issued (at timeout), the process proceeds to step ST**7**. Determination concerning the operation signal from the power supply switch is performed until the set time passes.

In step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state. After that, the process returns to step ST**1** in FIG. **8**.

On the condition that, as shown in step ST**8**, when the power supply switch is operated, an external interruption signal is generated to return the arithmetic processing section **17** to a state capable of processing with the predetermined operating speed, in step ST**9**, the system activation process is normally performed in accordance with the power-supply instruction (this process is similar to that in the related art) before the process proceeds to step ST**10**.

In step ST**10**, the operation of the system configuration unit, for example, the image signal processing section **5***a*, is completed. A backlight, or the like, included in the image display section **5***b* emits light to display a screen.

It takes almost no time from the time the power supply switch is performed in step ST**6** until the process proceeds to step ST**10**. In other words, instantly after the user operates the power supply switch, image capturing preparation is established.

The process proceeds to step ST**11**, and, in step ST**11**, on the basis of an operation on the shutter release button, it is determined whether or not an image capturing instruction has been issued. If an image-capturing-instruction signal has been sent to the system, the process proceeds to step ST**12** and an image capturing process is initiated.

In the (1) analog system, by allowing the system controller to have threshold data, flexible determination using software can be performed. Accordingly, a detected value obtained by the detecting unit **13** can be used for other uses such as image stabilizing. In addition, the detecting unit **13** does not need to include any communication circuit for communicating with a comparator and the system controller. Thus, the detecting unit **13** has an advantage in reducing the size of the detecting unit **13**, reducing the number of components, and reducing an area and space for installation.

Next, the (2) digital system is described below.

FIG. **10** is a block diagram showing a main part of an example configuration **12**A of the (2-1) binarization system.

A detecting unit **13**A includes a data storage section **16** and a comparator **15** other than sensors. An electrostatic sensor serving as a contact detecting sensor **3***a* and an angular velocity sensor serving as an attitude detecting sensor **3***b* are used. Each sensor output signal is sent to the comparator **15**.

The data storage section **16** stores threshold data that is written in shipping by a data writing device **18**. The threshold data is read and sent to the comparator **15**.

The comparator **15** performs comparison operations between a sensor detection signal and a signal representing the threshold data. As a result, when the sensor detection value satisfies a condition represented by the threshold data, it is recognized that, for example, the user touches a predetermined area of a camera, or changing to the image capturing mode is initiated such that the user holds the camera. A binary signal (e.g., an H-level signal) representing the result of the recognition is output to the second control unit **4***b*. When the sensor detection value does not satisfy the condition represented by the threshold data, it is determined that the image capturing mode is not set, or temporary or accidental contact or change in attitude or disturbance such as noise occurs. A binary signal (e.g., an L-level signal) representing the signal is output to the second control unit **4***b*.

In addition to the configuration using the data storage section **16** for storing the threshold data, there is, for example, a configuration in which a threshold value is set by adjusting, in shipping, a constant value set for the comparator **15** by an external circuit **19**. In FIG. **10**, both configurations are shown for brevity of description.

A second control unit **4***b* includes an interruption generating section **20** and an arithmetic processing section **17** (such as a CPU core or ASIC). An output signal of the comparator **15**, that is, a binarized signal, is sent to the interruption generating section **20**. When the interruption generating section **20** receives a signal representing the start of changing to the image capturing mode, the arithmetic processing section **17** is interrupted to cancel a sleep state, so that the arithmetic processing section **17** enters a state in which the CPU core or the like can perform processing with a predetermined operating speed.

FIG. **11** is a flowchart showing a main part of an example of the system activation process concerning the (2-1) binarization system. FIG. **11** shows only differences from the example described concerning the (1) analog system.

In step ST**20**, the comparator **15** compares the sensor detection signal and a threshold data signal. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**21**. If not, the sensor detection signal is continuously monitored.

In step ST**21**, in response to the binary signal from the comparator **15**, the interruption generating section **20** generates an interruption signal for the arithmetic processing section **17**, and the sleep state of the arithmetic processing section **17** is canceled. This allows the arithmetic processing section **17** to perform processing with a predetermined operating speed in step ST**22**. After that, the process proceeds to step ST**4** in FIG. **9**.

The subsequent processing is as described with reference to FIG. **9**. However, after, in step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state, the process returns to step ST**20** in FIG. **11**. In the sleep state, the power consumption is low since only the interruption generating section **20** operates in the second control unit **4***b*.

FIG. **12** is a block diagram showing a main part of an example configuration **12**B in the (2-2) serial system.

Differences from the configuration shown in FIG. **10** are described below.

A detecting unit **13**B includes a serial communicator **21** at a stage after a comparator **15**.

A second control unit **4***b* includes a serial-communication-and-interruption-generating section **22** for exchanging information with the serial communicator **21**.

In a configuration in which an arithmetic processing section **17** compares detection data sent as serial data from the detecting unit **13**B with threshold data stored in a data storage section **16**, the data storage section **16** is included in a second control unit **4***b*, and, in shipping, a data writing device **18** is used to write the threshold data or the like in the data storage section **16**. For example, a comparator **15** in the detecting unit **13**B is not necessary and a sensor detection signal is sent to the second control unit **4***b* through the serial communicator **21**.

In this example, the data storage section **16** for storing the threshold data may be provided in the detecting unit **13**A similarly to FIG. **10**. For brevity of description, FIG. **12** shows both a configuration in which the data storage section **16** for storing the threshold data is provided in the second control unit **4***b*, and a configuration in which a threshold value is set by adjusting, in shipping, a constant value set for the comparator **15** by an external circuit **19**. In a form that uses both comparison using the comparator **15** in the detecting unit **13**B and comparison performed by the arithmetic processing section **17** using the data storage section **16**, Implementation of double determination can enhance reliability, and is useful in verifying a determination result and backing up the comparison (for example, when the comparator **15** malfunctions).

The comparator **15** or the arithmetic processing section **17** performs comparison operations between the sensor detection value and the threshold data. When the result of the comparison indicates that the sensor output value satisfies a condition represented by the threshold data, it is recognized that, for example, the user touches a predetermined area of a camera, or changing to the image capturing mode is initiated such that the user holds the camera. Data representing the recognition result or the sensor detection data is transmitted from the serial communicator **21** to the serial-communication-and-interruption-generating section **22**. If the sensor output value does not satisfy the condition represented by the threshold data, it is determined that the image capturing mode is not set, or temporary or accidental contact or change in attitude or disturbance such as noise occurs. Data representing the result or the sensor detection data is transmitted from the serial communicator **21** to the serial-communication-and-interruption-generating section **22**. Various types of formats (SIO, UART, 12C, etc.,) may be used for a serial communication format.

In a form in which the detecting unit **13**B includes the comparator **15**, when the serial-communication-and-interruption-generating section **22** receives, for example, the signal representing the start of changing to the image capturing mode, the arithmetic processing section **17** is interrupted to cancel its sleep state, whereby the CPU core or the like is in a state capable of performing processing with a predetermined operating speed.

In a form in which the second control unit **4***b* includes the data storage section **16**, when the serial-communication-and-interruption-generating section **22** receives the sensor detection data, an interruption is generated allowing the arithmetic processing section **17** to compare the sensor detection value and the threshold value from the data storage section **16**. As a result, when it is determined that changing to the image capturing mode is started, the CPU core or the like is in a state capable of performing processing with a predetermined operating speed.

FIG. **13** is a flowchart showing a main part of an example of the system activation process concerning the (2-2) serial sys-

tem. FIG. **13** shows only differences from the example of the process described concerning the (1) analog system.

In step ST**30**, for example, the sensor detection value and the threshold value are compared by the comparator **15**. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**31**. If not, the sensor detection value is continuously monitored.

In step ST**31**, the comparator **15** interrupts the arithmetic processing section **17** through the serial communicator **21**, and the sleep state is canceled in the arithmetic processing section **17**. This allows the arithmetic processing section **17** in step ST**32** to be in a state capable of performing processing with a predetermined operating speed.

The subsequent processing is as described with reference to FIG. **9**. After the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state in step ST**7**, the process returns to step ST**30** in FIG. **13**.

Since, in this system, serial data communication is used for information transfer between the detecting unit **13**B and the second control unit **4***b*, this system has advantages such as ability to transmit and receive a more amount of information compared with the (2-1) binarization system. Accordingly, also an arithmetic processing section using a CPU or the like can re-compare data. Thus, flexible responses are possible concerning sensor recognition. In addition, an interruption is generated such that the detection data from the detecting unit **13**B is sent to the second control unit **4***b* through serial communication. Thus, the second control unit **4***b* can operate in a state (power saving mode) having low power consumption.

As described above, in the (1) analog system, in comparison between the detecting unit and the second control unit **4***b*, the configuration of the detecting unit is simplified. In the (2) digital systems, the configuration of the second control unit **4***b* is simplified.

Next, form (III), that is, the configuration for enhancing detection accuracy by combining detection of contact with the device and detection of a change in attitude of the device, is described below.

For example, when an electrostatic sensor detects contact of fingers with a camera body, and an angular velocity sensor detects, as a change in velocity, a change in attitude in holding the camera, it is determined that the image capturing mode is set, and the system activation process is performed.

FIG. **14** shows a setting method example concerning system activation. Examples of screens are shown in portions (A) to (H) of FIG. **14**. In this setting method example, as setting items concerning three types of mode, "INSTANT START," "NORMAL," "HIGH SPEED," "MAXIMUM SPEED," are selectable.

Portions (A) to (C) are similar to those in FIG. **5**. In each of portions (C) and (D), for the item "INSTANT START," a "NORMAL" mode is set.

The user performs a "right" directional operation in a state in which the cursor is positioned in the item "INSTANT START" as shown in portion (D) of FIG. **14**, whereby, as shown in portion (E), for the "INSTANT START," one of three modes becomes selectable.

Since, in this setting method example, the "NORMAL" mode has been set, by performing a "downward" directional operation with a cross key or the like, as shown in portion (F) of FIG. **14**, the user can position the cursor on a "HIGH SPEED" mode. By further performing the "downward" directional operation, as shown in portion (G) of FIG. **14**, the user can position the cursor on a "MAXIMUM SPEED" mode.

After that, by confirming the selected item, that is, pressing the center part (determination button) of the cross key or the like, the screen is changed to the screen shown in portion (H) of FIG. **14** and the setting operation finishes.

The above consecutive operations enable the "INSTANT START" to be set to a desired mode.

Next, an example configuration in which the (1) analog system and the (2) digital systems are applied to form (III) is described below.

At first, the configuration form of the form (I) is described below. In FIG. **7**, for example, the detecting unit **13** includes an electrostatic sensor and an angular velocity sensor, or an acceleration sensor, and an analog signal (indicated by the broken line arrow in FIG. **7**) output by each sensor is sent to the A/D converter **14**. The data storage section **16** stores, in units of sensors, threshold data that is written in shipping by using the data writing device **18**. The threshold data of each sensor is read and sent to the comparator **15**.

FIG. **15** is a flowchart showing a main part of the example of the system activation process in a case in which the above "HIGH SPEED" mode is set. FIG. **15** shows differences from the example of the process described with reference to FIG. **8**.

After a detection signal of each sensor is sent to the second control unit **4***b*, in step ST**40**, detection data by the electrostatic sensor and the threshold data from the data storage section **16** are sent and compared with each other in the comparator **15**. If the detection data satisfies a condition defined by the threshold data, the process proceeds to step ST**41**. If not, the sensor detection value is continuously monitored.

In step ST**41**, detection data (data obtained by A/D conversion) by the angular velocity sensor (or acceleration sensor) and the threshold data from the data storage section **16** are sent and compared with each other in the comparator **15**. If the detection data satisfies a condition defined by the threshold data, the process proceeds to step ST**42**. If not, the process returns to step ST**40**, and the sensor detection data is continuously monitored.

In step ST**42**, processing that is necessary for awaking the arithmetic processing section **17** from the sleep state is performed. In other words, the comparator **15** generates an interruption signal for the arithmetic processing section **17**, whereby its sleep state is canceled. This allows the arithmetic processing section **17** in step ST**43** to perform processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

The subsequent processing is as described with reference to FIG. **9**. After, in step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state, the process returns to step ST**40** shown in FIG. **15**.

In this example, the detection with the electrostatic sensor, that is, contact detection, is initially performed. In addition to that, device attitude detection may initially be performed. For example, in step ST**40**, the detection data with the angular velocity sensor or acceleration sensor and the threshold data may be compared with each other, and, in step ST**41** the detection data with the electrostatic sensor and the threshold data may be compared with each other.

In any case, the contact detection and the attitude detection ensure determining that the image capturing mode is set, and the system activation is performed.

FIG. **16** is a flowchart showing a main part of an example of the system activation process in a case in which the above "MAXIMUM SPEED" mode is set. FIG. **16** shows differences from those in the example of the process described with reference to FIG. **8**.

After the detection signal of each sensor is sent to the second control unit **4***b*, in step ST**50**, the detection data (data obtained by A/D conversion) with the electrostatic sensor and

the threshold data from the data storage section **16** are sent and compared with each other in the comparator **15**. If the detection data satisfies a condition defined by the threshold data, the process proceeds to step ST**51**. If not, the process proceeds to ST**53**.

In step ST**51**, processing that is necessary for awaking the arithmetic processing section **17** from the sleep state is performed. In other words, the comparator **15** generates an interruption signal for the arithmetic processing section **17**, whereby its sleep state is canceled. This allows the arithmetic processing section **17** in step ST**52** to perform processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

In step ST**53**, the detection data (data obtained by A/D conversion) with the angular velocity sensor or acceleration sensor and the threshold data from the data storage section **16** are sent and compared with each other in the comparator **15**. If the detection data satisfies a condition defined by the threshold data, the process proceeds to step ST**54**. If not, the process returns to step ST**50**, and the sensor detection value is continuously monitored.

In step ST**54**, processing that is necessary for awaking the arithmetic processing section **17** from the sleep state is performed. In other words, the comparator **15** generates an interruption signal for the arithmetic processing section **17**, whereby its sleep state is canceled. This allows the arithmetic processing section **17** in step ST**55** to perform processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

Although the subsequent processing is as described with reference to FIG. **9**, in step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state before the process returns to step ST**50** shown in FIG. **16**.

In FIG. **16**, for ease of understanding, the contact detection and the attitude detection are separately shown, but steps ST**51** and ST**54** are substantially identical in processing and steps ST**52** and ST**55** are substantially identical in processing. Thus, for example, if, in step ST**50**, the contact detection value satisfies a threshold condition, the process may proceed to step ST**54** (steps ST**51** and ST**52** are not necessary in this case).

Although, in this example, the detection with the electrostatic sensor, that is, the contact detection, is initially performed, this example is not limited to this manner. The device attitude detection may initially be performed, that is, for example, in step ST**50**, the detection data with the angular velocity sensor or acceleration sensor and the threshold data may be compared with each other, and, in step ST**53**, the detection data with the electrostatic sensor and the threshold data may be compared with each other.

In any case, when the contact detection or the attitude detection indicates that the image capturing mode is set, the system activation process is immediately performed.

Next, the (2-1) binarization system is described below.

In FIG. **10**, for example, the detecting unit **13**A includes an electrostatic sensor or angular velocity sensor, or an acceleration sensor. An output signal from each sensor is sent to the comparator **15**. The data storage section **16** stores, in units of sensors, threshold data that is written in shipping by using the data writing device **18**. The threshold data of each sensor is read and sent to the comparator **15**. Alternatively, by using the external circuit **19** for the comparator **15** to adjust a constant value for each sensor in shipping, each threshold value is set.

An output of the comparator **15**, that is, a binary signal, is sent to the interruption generating section **20**, whereby the arithmetic processing section **17** is interrupted.

A main part of an example of the system activation process in a case in which the "HIGH SPEED" mode is set is described below with reference to FIG. **15**.

After the detection signal of each sensor is sent to the second control unit **4***b*, in step ST**40**, the detection signal with the electrostatic sensor and a signal representing a threshold value for the detection signal are compared with each other by the comparator **15**. If the sensor detection signal satisfies a condition defined by the threshold value, the process proceeds to step ST**41**. If not, the sensor detection signal is continuously monitored.

In step ST**41**, the detection signal with the angular velocity sensor or acceleration sensor and the threshold value signal are sent and compared with each other in the comparator **15**. If the sensor detection value satisfies the condition defined by the threshold value, the process proceeds to step ST**42**. If not, the process returns to step ST**40**, and the detection value is continuously monitored.

In step ST**42**, after the binary signal is sent from the comparator **15** to the interruption generating section **20**, an interruption signal generated by the interruption generating section **20** is sent to the arithmetic processing section **17**, whereby its sleep state is canceled. This allows the arithmetic processing section **17** in step ST**43** to perform processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

Although the subsequent processing is as described with reference to FIG. **9**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state before the process returns to step ST**40** shown in FIG. **15**.

In a form in which the device attitude detection is initially performed, for example, in step ST**40**, the detection value with the angular velocity sensor or acceleration sensor and the threshold value may be compared with each other, and, in step ST**41**, the detection value with the electrostatic sensor and the threshold value may be compared with each other.

In any case, on the basis of the binary signal, it is ensured that the image capturing mode is set by the contact detection and the attitude detection.

In the example of the system activation process in the case in which the "MAXIMUM SPEED" is set, in FIG. **16**, at first, the detection signal of each sensor is sent to the second control unit **4***b*.

In step ST**50**, the detection signal with the electrostatic sensor and a signal representing a threshold value of the detection signal are compared with each other by the comparator **15**. If the sensor detection signal satisfies a condition defined by the threshold value, the process proceeds to step ST**51**. If not, the process proceeds to step ST**53**.

In step ST**51**, the binary signal from the comparator is received by the interruption generating section **20**. This generates an interruption signal for the arithmetic processing section **17**, whereby its sleep state is canceled. In step ST**52**, the arithmetic processing section **17** enters a state capable of performing processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

In step ST**53**, the detection signal with the electrostatic sensor or acceleration sensor and the threshold value signal from the data storage section **16** are sent and compared with each other in the comparator **15**. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**74**. If not, the process returns to step ST**50**, and the sensor detection value is continuously monitored.

In step ST**54**, the binary signal is received from the comparator **15** by the interruption generating section **20**. This generates an interruption signal for the arithmetic processing

section **17**, whereby its sleep state is canceled. In step ST**55**, the arithmetic processing section **17** enters a state capable of performing processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

Although the subsequent processing is as described with reference to FIG. **9**, in step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state before the process returns to step ST**50** shown in FIG. **16**.

In the form in which the device attitude detection is initially performed, for example, in step ST**50**, the detection value with the angular velocity sensor or acceleration sensor and the threshold value may be compared with each other, and, in step ST**53**, the detection value with the electrostatic sensor and the threshold value may be compared with each other.

In any case, when, on the basis of the binary signal, it is ensured that the image capturing mode is set by the contact detection or attitude detection, the system activation process is immediately performed.

Next, the form of the (2-2) serial system is described below.

In FIG. **12**, for example, the detecting unit **13**B includes an electrostatic sensor and angular velocity sensor, or an acceleration sensor. An output signal of each sensor is sent to the comparator **15**, or is sent to the arithmetic processing section **17** through serial communication. The data storage section **16** stores, in units of sensors, threshold data that is written in shipping by using the data writing device **18**. Threshold data of each sensor is read and sent to the arithmetic processing section **17**. Alternatively, by using the external circuit **19** for the comparator **15** to adjust a constant value for each sensor, each threshold value is set.

The output signal of the comparator **15** is sent to the serial-communication-and-interruption-generating section **22** included in the second control unit **4***b* through the serial communicator **21**. An interruption signal generated by the serial communicator **21** is sent to the arithmetic processing section **17**. Alternatively, detection data from the detecting unit **13**B is transmitted and compared with the threshold value from the data storage section **16** in the arithmetic processing section **17**.

In the example of the system activation process in the case in which the "HIGH SPEED" mode is set, in FIG. **15**, the detection signal of each sensor is sent to the second control unit **4***b*.

In step ST**40**, for example, the detection signal with the electrostatic sensor and a signal representing a threshold value of the detection signal are sent and compared with each other in the comparator **15**. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**41**. If not, the sensor detection value is continuously monitored.

In step ST**41**, the detection signal with the angular velocity sensor or acceleration sensor and the threshold value signal are compared by the comparator **15**. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**42**. If not, the process returns to step ST**40**, and the sensor detection value is continuously monitored.

In step ST**42**, the signal is sent from the comparator to the serial-communication-and-interruption-generating section **22** through the serial communicator **21**, and an interruption signal generated by the serial-communication-and-interruption-generating section **22** is sent to the arithmetic processing section **17**, whereby its sleep state is canceled. This allows the arithmetic processing section **17** in step ST**43** to perform processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

Although the subsequent processing is as described with reference to FIG. **9**, in step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state before the process returns to step ST**40** shown in FIG. **15**.

Although, in this example, the detection with the electrostatic sensor, or the contact detection, is initially performed, a detection manner is not limited to this example. By initially performing the device attitude detection, for example, in step ST**40**, the detection value with the angular velocity sensor or acceleration sensor and the threshold value may be compared, and, in step ST**41**, the detection value with the electrostatic sensor and the threshold value may be compared.

In any case, serial communication is used to ensure determining that the image capturing mode is set by the contact detection and the attitude detection, and the system activation process is performed.

In a form that does use the comparator **15** in the detecting unit **13**B, in steps ST**40** and ST**41**, the detection data of each sensor is sent to the arithmetic processing section **17** through serial communication, whereby the arithmetic processing section **17** is interrupted. In the arithmetic processing section **17**, each detection value is compared with the threshold value from the data storage section **16**. When the comparison result indicates the start of changing to the image capturing mode, the process directly proceeds from step ST**41** to step ST**43**, and the CPU core or the like enters a state capable of performing processing with a predetermined operating speed.

In the example of the system activation process in the case in which the "MAXIMUM SPEED" mode is set, in FIG. **16**, at first, the detection signal of each sensor is sent to the second control unit **4***b*.

In step ST**50**, for example, the detection signal with the electrostatic sensor and the threshold value signal are compared by the comparator **15**. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**51**. If not, the process proceeds to step ST**53**.

In step ST**51**, the signal is sent from the comparator to the serial-communication-and-interruption-generating section **22** through the serial communicator **21**, whereby an interruption signal is generated for the arithmetic processing section **17**, and its sleep state is canceled. In step ST**53**, the arithmetic processing section **17** enters a state capable of performing processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

In step ST**53**, the detection signal with the angular velocity sensor or acceleration signal and the threshold value signal from the data storage section **16** are sent and compared with each other in the comparator **15**. If the sensor detection value satisfies a condition defined by the threshold value, the process proceeds to step ST**54**. If not, the process returns to step ST**50**, and the sensor detection value is continuously monitored.

In step ST**54**, the signal is sent from the comparator to the serial-communication-and-interruption-generating section **22** through the serial communicator **21**. This generates an interruption signal for the arithmetic processing section **17**, and its sleep state is canceled. In step ST**55**, the arithmetic processing section **17** enters a state capable of performing processing with a predetermined operating speed. The process proceeds to step ST**4** shown in FIG. **9**.

Although the subsequent processing is as described with reference to FIG. **9**, in step ST**7**, the CPU core or the like forming the arithmetic processing section **17** is set to the sleep state before the process returns to step ST**50** shown in FIG. **16**.

In a form in which the device attitude detection is initially performed, for example, in step ST**50**, the detection value with the angular velocity sensor or acceleration sensor and the threshold value may be compared with each other, and, in step ST**53**, the detection value with the electrostatic sensor and the threshold value may be compared with each other.

In any case, when serial communication is used to find that the image capturing mode is set by the contact detection or the attitude detection, the system activation process is immediately performed.

In the form that does use the comparator **15** in the detecting unit **13**B, in steps ST**50** and ST**53**, the detection data of each sensor is sent to the arithmetic processing section **17** through serial communication, and each detection value is compared with the threshold value from the data storage section **16** by the arithmetic processing section **17**. When the comparison result indicates the start of changing to the image capturing mode, the process proceeds to step ST**52** or ST**55**, and the CPU core of the like enters a state capable of performing processing with a predetermined operating speed.

According to the above-described configurations, for example, the following advantages are obtained.

Regarding Activating Functionality of System

In an image capturing device of the related art, it takes a time of approximately one second after pressing a power supply switch to completion of activation, even if the image capturing device has fast activating functionality. Accordingly, if a user of the device has a moment for capturing an image of a subject that passes instantly, a situation in which the user fails to perform image capturing occurs. Unlike that, as described above, by using a sensor, such as an electrostatic sensor or angular velocity sensor, to detect changing to an image capturing mode and a preparatory operation, and activating the system of the device in background without informing the user, a state in which image capturing can be immediately initiated can be guaranteed. As a result, a possibility of missing a shutter release opportunity is decreased.

Regarding Power Consumption of System

It is difficult to reduce a system activation time to zero. Thus, for example, in a method for ensuring a state capable of image capturing by continuously supplying power to the system, in compensation therefor, an increase in power consumption inevitably shortens a time of driving using a battery. This causes a problem in convenience. Specifically, it is necessary to carry a charged battery or the like on hand. Unlike that, as described above, in order to monitor detection of contact with the device, detection of a device attitude, a switch operation, etc., the device is set to a standby state with minimum necessary power consumption, and, when it is found that an image capturing mode is set in the device, supplying of power to the system is fully initiated to change the device state to a state capable of image capturing. In other words, the system power is not continuously on, so that unnecessary power is prevented from being consumed in a waiting state in which the user does not intend to perform image capturing. Thus, a power saving effect is sufficiently obtained, and, in application of an embodiment of the present invention to portable devices, a battery life can be extended.

It should be understood by those skilled in the art that various modifications, combinations, sub-combinations and alterations may occur depending on design requirements and other factors insofar as they are within the scope of the appended claims or the equivalents thereof.

The invention claimed is:

1. A portable apparatus having a function of image capturing comprising:

a processor including one or a plurality of control units;

a plurality of types of sensors including an image sensor, said sensors having respective outputs of multiple types capable of being input to said processor;

a display configured to display an image based on an image signal from said image sensor; and

a power supply unit to supply power to said processor, said sensors and said display,

wherein said portable apparatus is operable in a plurality of powered operational states including a first operational state and a second operational state, an image capturing operation being performable in the first operational state,

wherein said portable apparatus changes its operational state from the second operational state to the first operational state and said power supply unit supplies power to one or a plurality of components of the portable apparatus including said image sensor when receiving a first signal representing an activation of the image capturing operation in the second operational state according to a result of the output of one or a plurality of said sensors,

wherein said portable apparatus changes its operational state from the first operational state to a monitoring state and reduces power consumption of said display when there is not a second signal detected in a predetermined period, and

wherein at least one of said control units has a variably controllable operating frequency and controls the image capturing operation in the first operational state, and said operating frequency can be lowered so that power consumption of said at least one of the control units can be lower than other of said control units that control operation other than the image capturing operation.

2. A portable apparatus of claim **1** further comprising:

a detecting unit including one or a plurality of sensors of a touch sensor, an angular velocity sensor, a gyro sensor, an acceleration sensor, a vibration sensor, and an electrostatic sensor in addition to said image sensor.

3. A portable apparatus of claim **1**, wherein said first signal is based on the output of one or a plurality of the sensors of the same type, or sensors of different types.

4. A portable apparatus of claim **1**, wherein said first signal is based on the output of one or a plurality of the sensors, and at least one of the sensors is set to use a threshold in detection in order to provide an appropriate sensitivity.

5. A portable apparatus of claim **1**, wherein said first signal is based on the output of one or a plurality of the sensors, and at least part of at least one of the sensor's detecting result is usable in other function of the portable apparatus.

6. A portable apparatus of claim **1**, wherein said second signal represents a certain touch operation.

7. A portable apparatus of claim **1**, wherein transmitting forms of the output of said one or a plurality of sensors includes one from analog form, digital form, binary form and serial form.

8. A portable apparatus of claim **2**, wherein

power consumption of said one of the control units can be close to almost zero.

9. A processor for a portable apparatus, wherein the portable apparatus comprises a display and a plurality of types of sensors, said types of sensors including an image sensor, wherein said portable apparatus is operable in a plurality of powered operational states, said powered operational states including a first operational state and a second operational state, and an image capturing operation is performable in the first operational state,

wherein said sensors have respective outputs of multiple types capable of being input to said processor,

wherein said processor includes one or a plurality of control units, at least one of said control units having a variably controllable operating frequency and controlling the image capturing operation in the first operational state,

wherein said processor is to control said portable apparatus to (1) change its operational state from the second operational state to the first operational state and (2) supply power to one or a plurality of components of the portable apparatus including said image sensor when receiving a first signal representing an activation of the image capturing operation in the second operational state according to a result of the output of one or a plurality of said sensors,

wherein said processor is to control said portable apparatus to (1) change its operational state from the first operational state to a monitoring state and (2) reduce power consumption of said display when there is not a second signal detected in a predetermined period, and

wherein said operating frequency can be lowered so that power consumption of said at least one of the control units can be lower than other of said control units that control operation other than the image capturing operation.

10. A processor of claim **9**, wherein said processor is formed in a single chip.

11. A processor of claim **9**, wherein said processor is formed with a plurality of said control units on a single chip.

12. A processor of claim **9**, wherein said processor controls power supply to said one or plurality of components.

13. A processor of claim **9**, wherein said processor further comprises a data storage section.

14. A processor of claim **9**, wherein said processor further comprises a comparator.

15. A processor of claim **9**, wherein said processor supports sensors of at least one of a touch sensor, an angular velocity sensor, a gyro sensor, an acceleration sensor, a vibration sensor, and an electrostatic sensor in addition to said image sensor.

16. A processor of claim **9**, wherein said background processing includes initializing processing.

17. A processor of claim **9**, wherein said first signal is based on the output of one or a plurality of sensors of the same type, or sensors of different types.

18. A processor of claim **9**, wherein said first signal is based on the output of one or a plurality of sensors, and at least one of the sensors is set to use a threshold in detection in order to provide an appropriate sensitivity.

19. A processor of claim **9**, wherein said first signal is based on the output of one or a plurality of sensors, and at least part of at least one of the sensor's detecting result is usable in other function of the portable apparatus.

20. A processor of claim **9**, wherein said second signal represents a certain touch operation.

21. A processor of claim **9**, wherein said processor is configured to be connected with said sensors of different types through one or a plurality of interfaces.

22. A processor of claim **9**, wherein power consumption of said at least one of the control units can be close to almost zero.

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(54) **IMAGE CAPTURING DEVICE AND ACTIVATION METHOD THEREFOR**

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(57) **ABSTRACT**

An image capturing device includes a first controller operable to control image capturing; an operation section including a switch; a detector operable to detect a change to an image capturing mode and to send a signal representing the change; a second controller operable to monitor and process the sent signal, the second controller having a power consumption less than that of the first controller; and a power supply operable to supply power to the first controller, the second controller, and a functional section of the device. When the second controller receives the signal sent from the detecting section in a power saving state in which power is supplied from the power supply to the second controller, the power saving state is changed to a power supplying state capable of image capturing by supplying power from the power supply to portions of the device including the first controller.

22 Claims, 16 Drawing Sheets